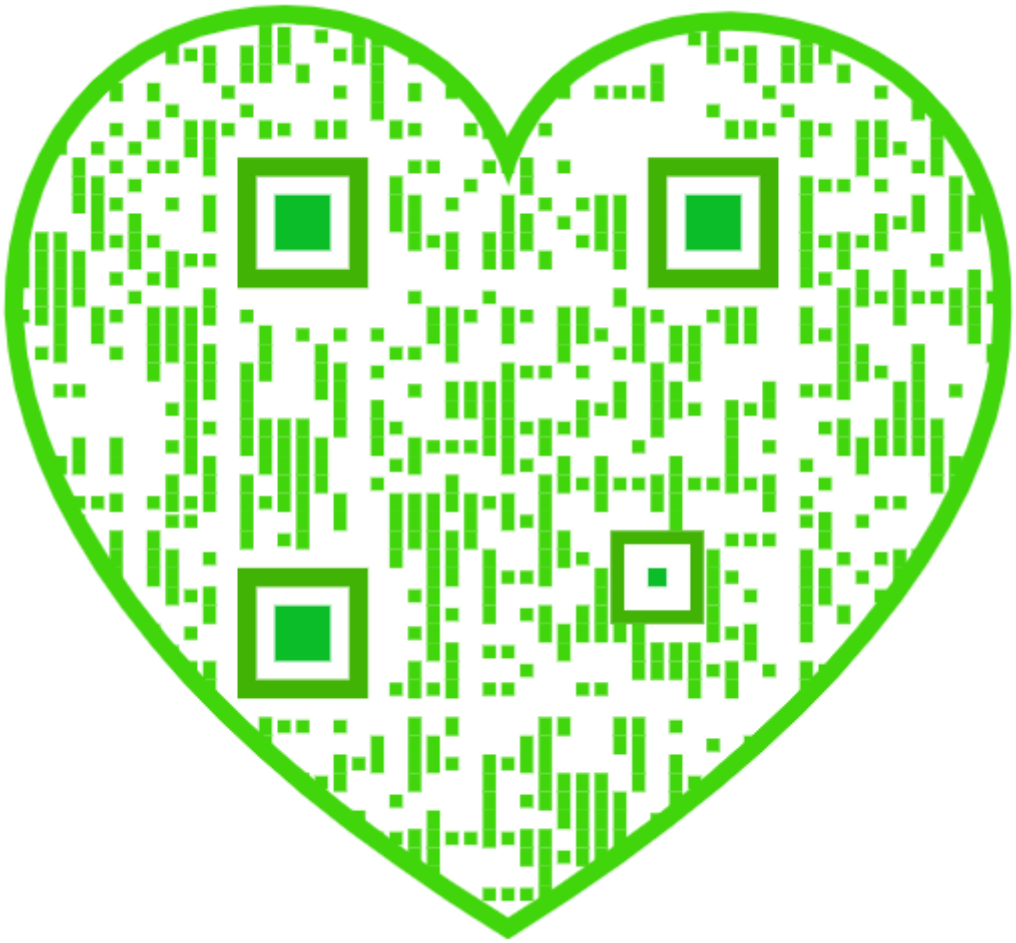

THE PRACTICAL
POLISH & VARNISH MAKER

A TREATISE

CONTAINING

750 PRACTICAL RECEIPTS AND FORMULÆ

FOR THE

MANUFACTURE OF POLISHES, LACQUERS, VARNISHES, AND JAPANS, OF ALL KINDS, FOR WORKERS IN WOOD AND METAL

AND

DIRECTIONS FOR USING

BY

H. C. STANDAGE

(*Practical Chemist*)

AUTHOR OF "THE ARTISTS' MANUAL OF PIGMENTS," "HANDBOOK OF WATER-COLOUR PIGMENTS," "THE USE AND ABUSE OF COLOURS AND MEDIUMS IN OIL PAINTING," ETC., ETC.

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PREFACE.

THE purport of this book is to put into the skilled mechanics' and amateurs' hands the means whereby they can readily prepare their own polishes, varnishes, lacquers, and japans.

There is a great deal of mystery associated with the manufacture of such articles, and the formulæ one finds in trade literature and periodicals devoted to the amateur mechanic are often seriously incomplete in some essential detail, which completely nullifies the value of the recipe; and thus published recipes become scornfully looked upon as being worthless, and *ipso facto* the professionally-made article trebly valued as being superior to that made at home.

Two causes undoubtedly conspire to produce this despising of published recipes: first, that the recipe is one that has usually been given by a fellow-amateur (because the skilled mechanic considers it *infra dig.* to "let out" any of his trade secrets), therefore the recipe is in most cases a very crude one; the second cause of published recipes being despised is that the amateur who essays to make a product from the recipe, neglects some essential process in the formula in his too great haste to accomplish the

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production of his essay. The result of his labour is unsatisfactory, and the recipe, not his own carelessness, becomes condemned.

To avoid any such disastrous results from following the formulæ given in this work, each recipe is clearly given as regards the precise proportion of the several ingredients to be used, and the directions for preparing each product. If these details be faithfully followed, a failure *cannot* result.

In a work of this kind, embracing such a large number of formulæ, and for such diverse purposes, great discrimination is necessary to set before my readers formulæ that can be relied on. When the writer states that a great many of the recipes have been practically tested by him before setting their formulæ on paper, he hopes that his readers will be perfectly confident in the reliableness of each and every formula.

Apart from the mere making of the products to be used, practical directions are given for the use of the various articles—be they polishes, lacquers, varnishes, &c.; and not alone is this the case with one material, but many materials have been so considered.

While the writer does not claim to be a professional polisher of wood, marble, &c., or lacquerer of metal, a japanner, or varnisher of furniture, &c., he would ask his readers to take his word for it, that the sources from which his information has been drawn on such points are perfectly reliable and practical.

On the question of varnishes, the great division of them into fat or oil varnishes, and volatile or spirit varnishes,

has led the writer to purvey only such as are likely to be capable of production by the amateur mechanic. Oil varnishes need elaborate and special apparatus for their successful production, and as the amateur operative will not care to spend a pound to save a penny by making such varnishes, details for their production are not given. To have given such working details would have considerably increased the size of the book, without materially adding to its usefulness; as to practical varnish manufacturers only would such details have appealed, and to them they would be like carrying coals to Newcastle.

As, however, varnish manufacturers will not unnaturally expect to find in such a work as is embraced by the title of this one, formulæ for the production of varnishes of all kinds, recipes for the practical production of such are given under the sections on fat or oil varnishes. By giving such recipes, the writer trusts he supplies the wants of the varnish manufacturer; while, in the sections on spirit varnishes, the amateur also will find that very simple and inexpensive utensils suffice for producing the articles he essays.

In a work of this kind, to attempt an elaborate classification would add but little to its usefulness, since it is the Index to which the seeker will naturally turn. Therefore, by means of cross-references, the Index has been made as complete as possible.

With these few words as to the *raison d'être* of the work, the writer leaves his reader to judge of its usefulness.

H. C. S.

Gravelly Hill, Birmingham,
June 20th, 1892.

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THE PRACTICAL
POLISH AND VARNISH MAKER.

CHAPTER I.

INGREDIENTS USED IN MAKING POLISHES, LACQUERS, VARNISHES AND JAPANS.

Acetone (*Pyroacetic spirit*).—This is a colourless liquid, obtained by distilling some of the acetates; it is used chiefly as a solvent for resins, gums, and camphor. When pure it has a density of 0·814 and boils at a temperature of 56° C. (132·8° F.). Acetone can be mixed in all proportions with other solvents of resins. As its price is high and there are cheaper solvents which readily perform the same functions, its use is not needed where cheapness is a consideration.

Alcohol.—This term as generally understood may signify spirits of various strengths, and we distinguish therefore between alcohol of 60, 70, 80 per cent., &c., meaning that in 100 volumes of the spirit there are contained 60, 70, or 80 volumes of absolute alcohol. Properly used, alcohol should refer to spirit that contains 91 per cent. and over, of the spirit, and the remainder water.

As this liquid readily imbibes moisture from the air it is impossible to keep it up to its full strength if exposed to the air, in fact it is never entirely free from water, as, although absolute alcohol is entirely free from water, when freshly prepared it so rapidly imbibes water from the air with great energy that the absolute alcohol met with in commerce is

sure to contain a small proportion of water. What is sold for absolute alcohol is rarely above 98 per cent.; the gravity of absolute alcohol is 0·793 at 60° F.

Spirits of Wine is the stronger alcohol that is generally found in commerce, and contains about 90 per cent. of alcohol and 10 per cent. of water. It derives its name from the fact that it was first obtained from the distillation of wine. The strongest commercial alcohol is about 95 per cent.

Rectified Spirits are spirits rendered stronger and purer by redistillation.

Cologne Spirit is the highest grade of alcohol, having been so purified as to be devoid of all colour and odour.

Proof Spirits or Diluted Alcohol.—Alcohol is said to be so much "over" or "under" proof according to its strength relative to a standard fixed by Government. The relative degrees of strength are ascertained by an instrument called an alcoholometer or hydrometer.

Wood Spirit or Methyl Alcohol is a spirit obtained among other products from the destructive distillation of wood. It has a peculiar odour.

Methylated Spirit is spirits of wine mixed with 10 per cent. of commercial wood spirits.

Wood Alcohol is obtained mixed with pyroligneous acid (crude wood vinegar) from the destructive distillation of wood. When this is heated in a still, the first portions distilling are impure wood spirit. This, purified by several rectifications (redistillations), yields common wood naphtha, empyreumatic matters, acetone, &c. What it contains may be removed by heating it in a still over a bath with an excess of chloride of calcium as long as volatile matters escape (impurities), then distilling the remainder with a quantity of water equal to the spirit taken. Rectification of this dilute spirit over lime yields pure wood naphtha—methylic alcohol.

Amber (*Succinum*).—This is a fossil resin, that is, a gum exuded by trees of a former age, which have become resinified, and now recovered from sandy plains and shores such as those of the Baltic. During storms, the amber, the specific gravity of which differs very little from that of water,

is thrown up on the beach, or it is obtained by dredging the sand, though in some places it is also mined. The usual colour of amber is yellow, though some pieces are brown, some cloudy and opaque, others transparent. Amber becomes electrified by friction; a fact well known to the ancients. When thrown on live coals, it burns with a white flame, and developes a strong odour; and when distilled in a closed retort, the dense fumes given off are recondensed, and an oil (*Oleum succini*) and water are formed in the receiver. This oil has no drying qualities, and is unfit for mixing with paint, as when mixed with red oxide of iron—a pigment, by the way, possessing strong and quick drying qualities when compounded with linseed oil as a paint—the mixture took over a month to become at all dry; then only a skin formed on the surface of the mixture, that beneath the skin being semifluid. The residuum left in the retort is a molasses-like mass (fatty balsam of amber) utterly destitute of drying qualities, and useless for making varnish.

The size of the pieces of amber found varies; the large pieces are used for making fancy articles, while the smaller pieces, and all chips that fall off in working amber, form the staple article used by the varnish maker.

As the price of amber is comparatively high, unscrupulous dealers do not forbear to adulterate it in various ways; thus amber is imitated by melting pure bleached shellac, and keeping it over the fire until it runs clear, with care to prevent burning. It may be poured into moulds of the size of pieces required. The operation requires considerable management. The darkest and hardest pieces of gum-copal are also substituted for amber; the copal may be fused with the shellac. Another method of producing fictitious amber is that of dissolving shellac in an alkaline lye, and then passing chlorine through the solution (*resinate*) until the whole of the lac is precipitated. After washing in water, the mass is melted and kept over the fire until it runs clear, care being taken that it does not burn: the mass is then poured into moulds of the size of the pieces required. To test amber for purity, experiments undertaken by the writer, to determine genuine from imitation amber, show

that the true amber-resin does not soften nor dissolve when boiled for five minutes in a saturated solution of sodium borate, whereas copal-resin dissolves, forming a gelatinous mixture when cold, and lac-resin dissolves and forms a thin watery fluid when boiled with such solution. Another test is to pound some of the chips in a wedgwood mortar; the chips of true amber will not readily be resolved into powder, the chips flying about, whereas copal-resin grinds up easily and well. To render amber soluble, cautiously heat the chips in an iron pot, and as soon as it becomes semiliquid, put an equal weight of boiled linseed oil, previously made hot, into the pot, and stir the resin and oil together until the whole is thoroughly blended. This mixture will keep for a long time if bottled, but on exposure to the air it forms into a tough elastic skin.

Aniline (*Phenylamine*).—This body is a volatile organic base, first noticed in empyreumatic bone oil, and afterward obtained from coal-tar as a product of various processes attending the destructive distillation of organic bodies. Aniline colours are prepared on a large scale in special factories, particularly so in Germany, several Berlin firms having established a world-wide reputation for their products. These colours are produced from coal-tar, and are obtained of all shades and tones of colour. When these colours are added to varnishes, the resulting colour is splendid, bright and sparkling, especially so when laid on a metallic surface. These beautiful colours, however, are not very stable, and therefore it were better to employ lacquers and varnishes coloured with the organic bodies, such as the dye-woods, &c., when a coloured durable varnish is required.

Aniline dyes are more or less soluble in water, but alcohol readily dissolves them; those colours which do not readily dissolve in water can be made to do so by dissolving gelatine in acetic acid, and dissolving the aniline colour in such solution, which is made like a syrup in thickness. It is stirred until an even coloured paste is obtained, then the mixture is heated in a glue-pot for some little time, and a little thinning with water is required.

Anime Resin.—This is a pale brownish-yellow transparent brittle resin, which exudes from the *Hymenæa courbaril* (Lynne) or Locust tree, *H. Martiana*, and other species of Hymenæa growing in tropical America. It contains about 2 per cent. of volatile oil, which gives it an agreeable odour; melts without decomposition, is nearly insoluble in alcohol and caoutchoucine, but forms a gelatinous mass on a mixture of the two.

Annotta (*Annotto, Annatto, Annatta, Arnatto, Arnotto*).—This body is the colouring matter which forms the outer pellicle of the seeds of the *Bixa Orellana* (Linn.), an exogenous evergreen tree common in Cayenne and some other parts of tropical America, and now extensively cultivated in both the East and West Indies. It is scarcely soluble in water, freely soluble in alcohol, ether, oils and fats, to each of which it imparts a beautiful orange colour. Its most important property is the affinity of its colouring matter for the fibres of silk, wool, and cotton, and also for giving a golden colour to varnishes and lacquers.

Asphaltum.—This body when native is also called black earth, Jews' pitch, bitumen, &c. It is found in many places upon the globe, stored in the earth or swimming upon the sea. The best known places where it is found are, for instance, the Dead Sea in Lystra and the pitch lake in the island of Trinidad.

Native asphaltum is a pitch-dark brittle mass with a flat conchoidal fracture. Generally it diffuses a disagreeable odour resembling that of burning coal, which is especially perceptible when it is heated. It melts easily and gives off heavy black vapours. When set on fire it burns with a bright flame, depositing large quantities of soot but leaving little ash, and this is made use of as a means of testing its purity, as adulterated asphaltum, which has been mixed with bad pitch, leaves a large quantity of ashes behind. It is much used for making excellent elastic black lacquers, especially suitable for lacquering ironware. Besides the native variety there is an artificial asphaltum—a chemical product—obtained from the distillation of tar oils. This variety

is as useful as the native kind and is equally applicable for the same purposes.

Liquid Asphaltum is a compound product used as a black japan or varnish, and as a glazing colour by artists. The ordinary kind is made by melting 2 ozs. Scio turpentine, adding 1 oz. of asphaltum in powder, mixing the two, and when cool reducing with hot oil of turpentine.

Wilson's liquid asphalte is made by melting ½ lb. asphaltum, adding 1 lb. hot balsam of copaiba; and, when mixed, thin with hot oil of turpentine.

Beeswax.—Is obtained from the cells of the bees; it is largely adulterated. Commercially there is a distinction made between the yellow or unbleached wax and the bleached or white wax. The former is chiefly used for floor varnishes, while the white wax is only used in the preparation of some varnishes. The adulteration of the wax is chiefly a vegetable substance, the so-called Japanese wax. Beeswax only partly dissolves in boiling spirits of wine, but does so entirely in ether, oil of turpentine, benzine and sulphide of carbon.

Bleaching of Wax.—When beeswax is exposed in thin layers to the air and to direct sunlight it is quickly rendered colourless; but in the dusk, in presence of a fresh supply of air, oxygen or ozone, no decolorization whatever is effected even after a long time. The presence of sunlight, oxygen, and especially ozone, destroys the colour very rapidly, but the presence of oxygen is not absolutely necessary when the wax is exposed to sunlight *in vacuo* or in an atmosphere of carbonic anhydride. It is bleached, but much more slowly than in the presence of air. The composition of the unbleached wax differs considerably from that of wax which has been bleached by exposure to air and sunlight. The latter contains a slightly larger percentage of free acids, but a large proportion of the unsaturated acids of the oleic series and of the unsaturated hydrocarbons in the crude wax have disappeared. This fact shows that in the bleaching process not only does the colouring matter suffer total combustion, but the unsaturated acids and the unsaturated hydrocarbons are converted into saturated compounds by the

fixation of oxygen. This is also the case with other fatty substances such as suet, and the reason why the addition of 1 to 5 per cent. of suet to beeswax causes decolorization to proceed more quickly, is because the suet in its oxidation or combustion aids the destruction of the colouring matters. The addition of a small quantity of other oxidizable substances, such as essence of terebene, also hastens the action, so that it would seem that the destruction of the colouring matter is due to the formation of ozone by the oxidation of the added substance.

Benzine.—This fluid is an ethereal hydrocarbon obtained in many ways, principally from the distillation of petroleum. It is very useful in the arts as a solvent, and for the removal of grease spots, &c. The benzol (another name for benzine) of commerce is chiefly obtained from coal-tar naphtha.

To deodorize benzine, shake it repeatedly with fresh portions of metallic quicksilver. Let it stand for two days, then rectify or shake with plumbate of soda (oxide of lead dissolved in caustic soda), then rectify. Simply shaking with charcoal and filtering, will practically remove the odour, or else digest litharge in strong solution of soda, and shake the benzine up with this.

Bisulphide of Carbon (*Alcohol sulphuris*).—This body is obtained by a combustion of carbon in sulphuric vapour, and by introducing the former vapour into a vessel filled with ice. It is a colourless fluid refracting light strongly, has a peculiar disagreeable odour resembling that of radishes, is very inflammable, of great density, and boils at a temperature of 143° C. (109·6° F.). As this liquid is very volatile it must be stored under water, especially so as the vapours given off are highly poisonous, if in large quantities. The price is low, and as the fluid possesses the property of very easily dissolving resins, caoutchouc, &c., it is very frequently used as an excellent solvent for resins. Only the pure bisulphide should be used in lacquer and varnish making; as an impure article—that is, such as holds but small quantities of free sulphur in solution—is not very suitable,

as the lacquers prepared therewith will show but little gloss when they have become dry.

Borate of Manganese.—Is the most important of all the compounds of manganese used for the fabrication of varnishes, for which purpose the borate should be perfectly free from traces of iron, as if the borate contain any iron, the varnish prepared with such borate will dry very slowly, while varnish prepared with a pure article dries remarkably quick. For varnishes that are to be used for superior purposes, this salt should always be employed as a drier in place of litharge, sugar of lead or other lead-driers. And although it causes the oil or varnish to harden and dry quickly, it does not exert any dangerous chemical action on the oil, whereas lead-salts saponify them, whence they are rendered less permanent, and are more liable to darken colours that are affected by the presence of lead, *e.g.* white lead.

Canada Balsam.—This is supplied by the *Abies balsamifera.* It is contained in blisters in the bark. The blisters are punctured and the balsam is collected as it exudes. This is a most useful substance, being in demand in many industries.

Caoutchouc.—India-rubber is the product of many euphorbiaceous plants. We get most of it from the Brazils and Central America. In Brazil, it is obtained from the *Siphonia elastica*, which grows to a height of between fifty to sixty feet, and in Central America it is obtained from *Castilloa elastica.* Most of that we now use comes from Central America, where the juice is simply collected into cups from incisions made in the bark. To coagulate the milky juice and convert it into rubber fit for exportation, the juice of a vine called Achuca is mixed with it, and so powerful is its action that five or six minutes is sufficient to produce coagulation.

The Brazilian method slightly differs. The juice is first collected in clay bowls, it is then smeared in various-shaped moulds, made also in clay, and taking the forms of bottles,

balls, spindles, &c. Successive coats are laid on, each one having previously been allowed to thoroughly dry, either in the sun or the smoke of a fire, which blackens it. When a sufficient thickness is obtained the clay is washed out leaving the india-rubber ready for exportation. The tree yields twenty to thirty gallons of juice, and each gallon will produce two pounds of marketable india-rubber. Other trees producing caoutchouc are *Siphonium brasiliensis*, *S. lutea*, *S. brevifolia*. *Gummi elasticum* is the thickened milky juice of different trees indigenous to the tropical regions, but it is also found in our European varieties of milk-weeds (*Asclepiadeæ*) though not in sufficient quantities for industrial purposes. It forms a tough, very elastic mass composed of carbon and hydrogen. It can only be partly dissolved in most of the known solvents, while what remains swells up, and can be dissolved with the least difficulty in those soluble products which are formed by ready distillation of the caoutchouc itself. Besides the ordinary caoutchouc there comes into the market also the vulcanized and hard caoutchouc. Vulcanized caoutchouc is of a greyish colour and is obtained by treating ordinary caoutchouc with sulphur. *This variety cannot be used for all fabrications of lacquers and varnishes.* The hard variety is also gained by chemically treating the ordinary variety. It forms hard masses of a black colour, resembling somewhat buffalo horn; the rubber combs are made from it, and is suitable for the manufacture of some important lacquers.

Castor Oil (*Ricini oleum*).—Cold-drawn castor oil is of the best quality. It is prepared by pressing the shelled and crushed fruit or seed in hempen bags in hydraulic presses. The oil as it escapes is received into well-tinned vessels, in which it is afterwards mixed with water and heated till the water boils, and the albumen and gum separate in a scum; this is carefully removed, and the oil as soon as it has become cold is filtered through Canton flannel and put into canisters. It is tinned cold-drawn, and is of a light straw colour.

Common kinds of oils are prepared by gently heating the crushed seeds and pressing them while hot. Another

method sometimes adopted is to put the crushed seed into loose bags, to boil them in water, and to skim off the flowing oil. The oils prepared by continued roasting and boiling are darker in colour than when cold-drawn. They are also more viscid and soon become rancid. They are used for lamps in Indian bazaars.

In the United States a somewhat different method of extraction is adopted. The cleansed seeds are heated in an iron tank, with care to avoid scorching. Pressure is then applied, and first-quality oil is drawn off; the pressed residue is again heated and squeezed, the product being second-quality oil. The third-quality oil is obtained after a repetition of the heating and pressure. Each of these three products has to be further prepared by heating with water as described above under cold-drawn oil. Castor oil is used in varnishes, especially those varieties for photographers, to render them flexible and prevent brittleness.

Cerasin.—This is a name given to an artificial wax similar in appearance to the natural variety, which may be used for the fabrication of varnishes for floors. As far as its chemical properties are concerned it has nothing in common with wax.

Collodion.—Is sometimes used as a solvent for resin. This article is best bought ready prepared, but then it is not very difficult to make oneself. Thus: mix 6 ozs. of sulphuric acid, 4 ozs. nitric acid at 1·450 sp. gr., and 2 ozs. of water. The temperature will rise to about 170° F. (77° C.). When it is cooled down to about 100° F. (38° C.) immerse perfectly dry cotton-wool, best carded and of long fibre, push it in under the acid with a piece of glass rod, and let each piece be well saturated before adding another. Cover the vessel, and leave it for twelve to twenty hours in a situation where any fumes generated may escape into the outer air. Next lift the cotton out and plunge it quickly into a large quantity of water, separate the tufts with pieces of glass, wash in charges of water till no acid is left. Wring the cotton in a coarse towel as dry as possible, and then pull out the tufts and place them in the air to dry. Collodion made with this

cotton (by digesting it in ether, &c.) will be very soluble, and leave no sediment; 5 to 6 grains will dissolve in 1 oz. mixed ether and alcohol, and still the collodion will be very fluid.

For coloured collodion take 1 oz. of collodion, 3 grains of pure annatto, and 3 grains genuine dragon's blood; digest with frequent shakings in a stoppered bottle for 24 hours, and if necessary decant the clear portion.

Now take 2 ozs. collodion, 1 drachm palm oil, alkanet root 15 grains. Digest, &c., as before.

These two recipes are for preparing a film to lay over cuts in the flesh so as to prevent the operators being poisoned by the touching of any chemical until same are healed up.

Colophony.—This body is obtained from our coniferæ. The resinous turpentine is the balsam of this resin, consisting of oil of turpentine or resin. Purer and common resin (*i.e.* colophony) has a light amber colour, is transparent as glass, and very brittle. Common resin that is less pure is called pitch, yellow, red or black pitch. A common name for this article is rosin, which refers to the remains of turpentine after the oil has been distilled.

Colouring of Varnishes.—The best plan is to colour the varnish after the entire work has been finished. First an entirely clear solution of the colouring matter should be prepared in alcohol, and this should be as concentrated as possible. Enough of this saturated solution is added to the fat varnish to produce the desired shade of colour. But as a considerable quantity of the solution of many colouring substances has to be taken for this purpose, it might be the case that in consequence of this the varnish would turn out too thin. This must be therefore taken into consideration, and the varnish must be made somewhat more viscid When aniline colours are used no attention need be paid to a possible thinning of the varnish in consequence of the addition of the solution of colouring matter, as these colours dissolve easily and are very productive of good results.

Copal.—This is the product of several leguminous plants in Africa, East Indies, South America and Australia. It is generally seen in large angular lumps, often as large as a hen's egg, of a bright yellow colour and very transparent. The African variety is of a darker colour and not so transparent; its surface appears dusty. The Australian is the largest. That from the East Indies is the product of the *Hymenæa courbaril*, in lumps sometimes nearly square, and generally covered all over with slight indentations. It is known as gum anime. This resin is chiefly used for fine varnishes only. As the qualities of copal vary, so do its prices. There is usually a distinction made between the copal from the East and the West Indies, though a large number of the varieties are named after the locality from which they have been brought into the market. Differing from all other resins in this respect, all copal resins are rough and melt only at a very high temperature, and can only be dissolved with great difficulty in the solvents ordinarily used for resins. In this it resembles amber, and further, many of the varieties are dug out of the ground like the latter, while other varieties are gathered from the trees themselves. It is very likely that the copal which has been dug out of the ground is also a product of extinct trees.

Copal is the *most important* of all resins used for the fabrication of fat lacquers, and for this reason we consider it necessary to describe more fully the principal varieties. Generally, copal is divided into two classes, namely, hard and soft copal. Rock salt can be easily scratched with the hard variety.

Hard Copal, East India Copal, Zanzibar Copal.—This variety is dug out of the ground and comes from the east coast of Africa. Its form is mostly flat discoid pieces, from the size of a pea up to that of a hand. These pieces are either entirely colourless or yellow to a dark reddish brown, and are transparent. The surface of this copal is peculiarly crusty and so hard that it can be ground.

Copal from Sierra Léone comes mostly in the form of globes or drops; forms at the utmost pieces as large as a nut, and is equally as hard as the East India copal.

Gaboon Copal is roundish, of a yellow colour, and many

pieces are clouded blood-red. Angola copal resembles very much the Zanzibar copal, but consists mostly of globular, somewhat flattened pieces, which are almost always of a dark golden yellow colour, but somewhat softer than the other varieties.

Soft Copal: West India Copal.—By this name certain varieties of copal are known which mostly come into the market from the west coast of Africa, and only rarely small quantities from South America. While the plants which secrete the East India copal are entirely unknown to us, we do know that the South American copal is obtained from different plants belonging to the Hymenæa family. The West Indian copal forms globular or drop-like pieces from the size of a pea to that of the fist, is white, transparent and sometimes, but rarely, clouded. It is so soft that it will lose substance when rubbed upon woollen stuff.

Kawrie Copal is obtained from *Dammara Australis*, indigenous to New Zealand, and forms sometimes lumps weighing over 50 kilogrammes (110 lbs.). Lighter and darker streaks run through these lumps, and they have an aromatic odour. While all other varieties become gritty when chewed, this variety sticks to the teeth. On account of its low price the Kawrie copal is most used at the present time for the manufacture of varnishes.

The Manilla and Borneo Copals resemble very much the New Zealand products.

Hard Copal has no taste nor smell. The soft varieties have an aromatic smell and taste. Copal is easily dissolved by chloroform and absolute alcohol, but in the latter only when it has been first soaked in ether. It is very difficult to dissolve in benzol, oil of turpentine, petroleum, naphtha—all excellent solvents for other resins. The addition of camphor aids in the dissolving of copal; this resin dissolves easily when it has been first subjected to a partial dry distillation. By holding a little of the gum before a fire so that as soon as it melts it may drop into a pan of water, a kind of oil separates from it, and the copal becomes soluble in spirits of wine and still more so if the melting is repeated.

When copal is powdered and exposed to the air in a thin

layer in sieves covered with paper for three or four months, it becomes soluble in absolute alcohol.

Many experiments have been made to dissolve this resin without subjecting it to distillation, but most manufacturers prefer distillation. A mixture of bisulphide of carbon, oil of turpentine, and benzol in equal proportions will effect the solution of copal. The powdered copal is allowed to stand for several days in this fluid contained in a closed vessel. The amount of copal taken at one time is usually one half of the weight of the fluids. The solution, which is seldom a complete one, is poured off and compounded with a fat oil.

Cottonseed Oil (*Oleum gossypii seminum*).—This oil is prepared from the seeds separated from the lint or wool of *Gossypium barbadense*. The cleaned and decorticated seeds are pressed into cakes which are subjected to heat, and again pressed so as to liberate the oil. The yield is from 12 to 20 per cent. The specific gravity of the crude oil varies from 0·928 to 0·930, and of the refined oil from 0·920 to 0·923, and the congealing point from 45° F. to 32° F. The refined oil has a yellowish-brown colour and a somewhat pleasant flavour. It possesses slight drying properties, but is sometimes classed among non-drying oils. This oil is used for lamps, paints, soap-making, and for adulterating other oils, &c.

Crocus.—This term, as employed in all mechanical arts, usually refers to a preparation of the oxide of iron used for polishing pistols and guns. But the term is generic and not specific, and means from the Greek "Saffron," a colour. It is applied also to an oxide of copper and an oxide of antimony. It is coarser than rouge. Green vitriol (ferrous sulphate) is mixed with potassic nitrate and sodic chloride. The mixture is stirred up with water so that a thin paste is formed. The mixture should now be placed in an iron crucible and heated very gradually until dry, then heat in a Hessian crucible until red hot, then pour out, cool, powder, boil with water and elutriate if necessary.

Dammar Resin.—Gum dammar is obtained from *Dammara Orientalis*, which is cultivated in the East Indies. It is also obtained from the *Pinus dammara*, a native of India. The resin is gained by incisions made in the trunks of the plants or the voluntarily exuding mass is gathered. Dammar resin forms drop-like masses as large as a small apple, or sometimes also larger pieces, resembling icicles. These pieces are either entirely colourless or very light yellow and smooth. The warmth of the hand is sufficient to make dammar sticky, and a powder is formed by rubbing it with the fingers. It becomes entirely soft at 70° C. (158° F.); at 100° C. (212° F.) it forms a viscous mass, and becomes fluid at 150° C. (302° F.). It can be entirely dissolved in hot spirits of wine, but only partly so in cold alcohol; but benzole dissolves it, which renders it very useful in making varnishes for photographic purposes. It is sometimes used as a substitute for Canada balsam. The variety which comes into the market as *Damma Australis* is Kawrie copal.

Dragon's Blood (*Sanguia Draconis*).—Is a resin of a rich deep, dark red colour obtained from various species of the genus *Calamus Dracæna*, which are indigenous in the tropical regions, as well as from other plants. Its colour in the lump is a dark brown-red, in powder bright red. It is friable, breaks with a shiny fracture, and has a specific gravity not higher than 1·196 or 1·197. When pure it readily dissolves in alcohol, ether, and oils, and yields rich red transparent solutions. Adulterated and fictitious dragon's blood is only partially soluble and lacks the rich colour of the genuine article. Its chief use is to tinge varnishes and lacquers. Dragon's blood comes into the market only in the form of small balls or in sticks about 11½ inches long, in both cases enveloped in leaves, or in irregular masses which look as if they had been melted. Several varieties of these articles are found in commerce, but especially that from the East and West Indies and from Africa. When dragon's blood is heated it diffuses an odour similar to that of storax. The commercial article is often badly adulterated, even products which consist of gum coloured with sanders-

wood are sold as dragon's blood. When the genuine article is rubbed against a glass plate it makes a mark very much resembling a streak of blood, which is not the case when the article has been adulterated. Fictitious dragon's blood is made of 7 parts red sanders-wood, 9 parts yellow resin, 2 parts castor oil, 3 parts benzoin, and 1 part oxalate of lime, 2 parts phosphate of lime, mixed together by heat.

Driers.—For a liquid drier boil a quart of linseed oil for an hour with a pound of finely-powdered binoxide of manganese. For a solid drier use borate of manganese in powder, or mixed with oil.

Resinates.—Digest resin in strong caustic potash or soda, purify the resinate from the liquid portion of the mixture by pouring it into cold water, collect this in a filter and dissolve it in hot water and again precipitate by a solution of a proportionate quantity of cobalt of manganese, chloride or sulphate. An amorphous resinate is formed, which collect on cloth filters; wash and dry. This forms an excellent drier to add to varnishes after they are made, filtering afterwards or during the process of boiling as for varnishes.

Transparent Zumatic Drier.—Nine lbs. zinc carbonate, 1 part borate of manganese, 9 parts of linseed oil; grind all together thoroughly, and keep it in stoppered bottles or tubes.

Opaque Zumatic Drier.—Manganese borate is so energetic that it is proper to reduce its action in the following manner:—

Take 25 lbs. zinc white and mix with 1 lb. of borate of manganese; shake thoroughly, first by hand, then in a revolving drum. This compound will be far preferable to use instead of litharge and other lead salts, when a permanent varnish is employed.

Drying Oil.—Is linseed oil boiled along with litharge, by which it acquires the property of drying quickly when exposed in a thin stratum to the air.

Elemi Resin.—Is obtained from trees belonging to the *Burseraceæ* family, and is produced in America, the East

Indies, and Manilla. Elemi forms either a very thick yellowish-white balsam, possessing a strong aromatic taste and smell like the Manilla elemi, or solid lamelliform masses like the Mexican elemi, which shows a conchoid fracture of a slight yellowish colour, becomes white as milk when exposed to the air, and covered with a white crystalline powder.

Elemi must be considered as an intermediary product. Besides two different kinds of resin, one of which is soluble in cold, and the other in hot spirits of wine, there are found in elemi varying quantities of essential oil. Elemi resin is seldom worked by itself for varnishes, but it is frequently added to other varnishes, as it prevents them from becoming brittle and cracking in drying.

The elemi of commerce is of a pale yellow colour, extremely brittle, but soft and tough working. It has a warm bitter taste and a fragrant aromatic smell partaking of fennel and juniper. It is only partially transparent, even in thin plates is very fusible, and has a density a little greater than that of water. According to one authority it consists of 84 per cent. of resin, 12·15 per cent. of a fragrant essential oil, and a little bitter extractive.

Ether.—Ethylic ether, sometimes commercially called, but wrongly so, sulphuric ether, is obtained by distilling spirits of wine with sulphur, and hence the name sulphuric ether. It is a fluid having a penetrating and overpowering smell, and a density of 0·736. It boils at 34·5° C. (94·1°F.), is very inflammable, and is miscible in any proportion with spirits of wine. Ether dissolves resins very easily, but varnishes prepared with it must always be thinned with spirits of wine, as they dry almost immediately on account of the low boiling point of the solvent. Ether vapours, like those of benzol and petroleum-naphtha, form a very explosive compound when mixed with air, and for this reason all fire or light must be carefully kept out of the room where these fluids are used, as the vapour is very penetrative, and filters through the air in a manner little suspected until, reaching a naked flame, an explosion results.

To find the percentage of ether and alcohol in a mixture

find the specific gravity at 60° F., while the following table will give the percentage of absolute ether contained in the mixture.

Sp. gr.	Per cent.
0·7198	100
0·7266	95
0·7293	90
0·7343	85
0·7397	80
0·7455	75
0·7514	70
0·7673	65
0·7636	60
0·7701	55
0·7772	50
0·7840	45
0·7880	40

Fuchsine or **Fuschine.**—is one of the red colouring matters obtained from aniline. It is generally included under the common name, Magenta.

Gamboge.—This so-called gum-resin. consisting of gum-resin and a bright yellow colouring matter, is a product of *Hedrodendron gambogioides*, native on the Malabar coast and in Ceylon. It is obtained by puncturing the bark of the tree when the flowers begin to appear. Commercially it appears in various forms, as pipe gamboge, cake gamboge, and lump gamboge. The best hollow rolls come from Siam. From this gum the beautiful yellow colour of gamboge is manufactured. Gamboge consists of the milky juices boiled down of the different trees belonging to the family of the *Guttiferæ*. The pieces are generally yellow or brownish-yellow, the surfaces being covered with a greenish powder and only somewhat transparent when very thin.

Gamboge dissolves only partially in alcohol (to the extent of 85 per cent.), but completely in ether. With water it forms an emulsion, *i.e.* the resin is kept suspended in the fluid, by the dissolved substances. Gamboge is of great value to the varnish manufacturers as it is used for preparing the so-called gold lacquer, a varnish used for coating gold-washed frames.

Guaiacum.—This resin exudes from the *Guaiacum officinale*, a native of Jamaica and the surrounding islands. A piece of paper treated with a tincture of guaiacum takes on a green tint under the violet rays, when exposed to the prismatic spectrum, through oxidation. Red rays destroy its colour. Solubility 90 per cent. in absolute alcohol. *Lignum vitæ*, the hardest and heaviest wood known, and which sinks on being placed in water, is the timber of this tree.

Gum-arabic.—This useful substance is yielded by several species of acacia. It is quite soluble in water, but insoluble in alcohol, ether and oils. It forms an acid solution, as permalate of lime is present. Several of the metallic oxides combine with it. It is very nutritious, so much so that the Arabs who gather it nearly live upon it during harvest-time. It is imported from the Levant, Barbary, Senegal, Cape of Good Hope, India, Cairo, &c.

Gum Benzoin.—Is the balsamic resin exuded from the incisions made in the stem of the *Styrax benzoin*, a native of Sumatra, Borneo, Laos and Siam. Several varieties of this article come into the market; two, however, are chiefly used in medicine—one in agglutinated masses; the other (from Siam) in tears, being the purer, and having the strongest odour. The best quality is the so-called almond benzoin, which consists of white grains caked together with a brownish resin between them, and which when it is heated diffuses an agreeable odour, somewhat like vanilla, but more balsamic. The second quality shows the white masses less frequently, is of a darker colour, and is frequently mixed with many chips and barks of wood. Benzoin fuses at a gentle heat. The best quality dissolves completely in strong spirits of wine. This resin is more frequently used in the manufacture of sealing-waxes than in varnish; but in the following pages some recipes comprise this body as an ingredient, its employment chiefly being on account of its agreeable odour.

Gutta Percha.—Gained from an East Indian tree, the *Isonandra gutta*. It is the inspissated juice found between

the bark and the wood. When freshly gathered it is rough, dry, slightly soluble, and very inflammable. To render it fit for use, it is put in boiling water; this softens it and renders it capable of being moulded into any shape, which it retains when cold. It is not a resin, in the same sense as those which we have already described, but a substance related to caoutchouc which flows from incisions made in the tree, and becomes hard when exposed to the air. The commercial gutta percha forms brownish tough, sometimes fibrous masses, which become thoroughly plastic at 60° C. (140° F.) and melt at 120° C. (248° F.). Gutta percha is easily dissolved in bisulphide of carbon and chloroform and also in petroleum naphtha. It remains as a waterproof coating after the solvent has evaporated. If the liquid thus obtained is poured upon gum, after a short time the gutta percha may be lifted in the form of a thin sheet, and the bisulphide evaporates very quickly.

Hemp Oil.—Is obtained by hot and cold pressure of the seeds of the hemp plant (*Cannabis sativa*). It has a light yellowish-green colour, but only as long as it is fresh. Old hemp oil becomes gradually darker, and finally assumes a dull brown colour. Generally hemp oil does not dry as well as linseed oil, but it can be very well used for varnishes, especially for those purposes where its dark colour will be no hindrance.

Indigo.—This beautiful blue colouring matter, one of the most constant we know of, is obtained from the indigo plant, *Anil indigofera*, indigenous in the Indies, but also cultivated in other tropical countries. It is gained from the plant by a peculiar chemical process. As indigo will not dissolve perfectly to form a transparent varnish, but a paint only, we need not further consider it.

Indigo Carmine, however, does dissolve completely to form a transparent lacquer. Indigo carmine is obtained from indigo by the following process:—

Place in a porcelain or earthenware pot 1 part of best indigo, finely pulverised, and 1 part each of fuming and

ordinary sulphuric acid, and stir constantly to avoid too strong heating, then cover the vessel and let it stand for 24 hours. When all the indigo has dissolved, which may be recognised by a drop taken from the pot and thrown into a glassful of water, colouring the latter blue without forming a precipitate, pour the solution into water, dilute it with ten times its volume of water, filter, and precipitate the indigo carmine with carbonate of potash or soda, as long as effervescence continues; collect the precipitate upon a filter of wool or felt, and let it drain off. Pure indigo carmine is soluble in pure water, but not in water containing salt.

To colour varnish with indigo carmine, rub up the carmine with the varnish upon the pounding-stone, and gradually add enough varnish to form a fluid mass, and then stir this into the rest of the varnish. Indigo should be bought in the lump, and that with a copper-coloured reflection is the best of all.

Lampblack.—This product is very finely divided carbon, which is separated in the form of black flakes mixed with other organic combinations by the combustion of resins and fat oils. Good lampblack, and in fact every variety of soot, should produce a fine mass which can be easily rubbed together with fat oil, and should be of a purely black colour. When lampblack is prepared at too low a temperature it has mostly a brownish shade of colour, while that which has been heated too much has a weak black colour, and is granular, which renders it more difficult to mix with the varnish.

A very superior lampblack is obtained by igniting a lump of camphor and holding a saucer over the flame to collect the soot, which, mixed with gum-arabic, makes a black superior to many Indian inks.

To free lampblack from greasy matters put it in an iron barrel or tube, close up the ends with clay—leaving one small orifice for the escape of gas—and heat it for an hour or more in a fire until it is of a dull red heat. Let it cool gradually, before taking it out of the tube. Keep in corked bottles.

Lampblack so purified makes a very superior black

enamel or lacquer to that made from inferior qualities of this black.

Linseed Oil (*Oleum lini*).—Commercially this oil is obtained from the seeds of *Linum usitatissimum*, as imported from Russia and India, which contain various properties of different cruciferous wood seeds. The oil has therefore usually an acrid taste derived from the presence of these impurities. Some growers of the plant purposely grow other plants and weeds on the same ground, whence all the seed being gathered together forms a quick means of adulterating the flax-seed.

In adulterating linseed oil there is great ingenuity employed, sometimes rosin, cottonseed or fish oil being added to expressed oil; or it may be that the seed is mixed, and the oil then expressed from such mixture.

There are three kinds of linseed oil, according to the method of preparation.

No. 1. Cold-Drawn (*Oleum lini sine Igne*).—The seeds are bruised or crushed, ground and expressed without heat. This is considered the best oil. It is pale, tasteless if pure, viscous, but does not keep as well as No. 2. By this process the seeds yield only from 17 per cent. to 22 per cent. of oil.

No. 2. Ordinary Linseed Oil.—This is prepared as No. 1, but with a steam heat of 200° F. It is amber-coloured or dark yellow, and is less viscous than the last. It solidifies at about 2° F. to 4° F. It is soluble in 5 parts of boiling and 40 parts of cold alcohol. Produce, 22 per cent. to 28 per cent. Both these are drying and catharic and are extensively used in paints, printing-inks, varnish, &c. In specific gravity they vary from 0·930 to 0·935.

No. 3. Boiled Linseed Oil.—The resinifying or drying property of oils is greatly increased by boiling them, either alone or along with some litharge, sugar of lead or white vitriol (*i.e.* sulphate of zinc), when the product forms the "boiled oil" or "drying oil" (*Olcum desiccativum*) of commerce. The efficacy of the process depends on the elimination of substances which impede the oxidation of the oil.

The addition of any one of the above bodies converts the

oil into a metallic soap, and it is the hardening of this metallic soap that gives the drying property to the oil. An oil prepared with any lead salt is only fit for common purposes. A much better product, chemically and physically, is obtained by using borate of manganese as a drier. (*See* DRIERS.)

Cold-pressed oil has a very light yellow colour, very little, but a peculiar taste and odour; the hot-pressed oil has a much darker colour, golden-yellow to amber, and the peculiar taste and odour of the oil are much stronger and more disagreeable. Good linseed oil should always be of light-yellow colour, should have but little odour, and when rubbed upon a glass plate should feel sticky to the touch within a few hours. The lighter the colour of a varnish or lacquer the more valuable is the product, but no colourless varnish can be manufactured with ordinary linseed oil, no matter how light it is in colour.

It is possible, however, to bleach the linseed oil by various processes in such a manner that it represents a perfectly colourless fluid clear as water. As, however, linseed oil is used only in the manufacture of fat varnishes, a subject beyond the scope of this work, we do not give directions for bleaching the oil.

Litharge.—Is the monoxide of lead, it is also called Massicot, and according to its lighter or darker colour, silver or white litharge or gold or red litharge. It is a yellow powder, which melts at a red heat, and is formed by heating lead in contact with the air, by which process, as is well known, a film is formed upon the surface of the metal which is renewed as fast as removed, and so on until all the lead has been oxidized. On a large scale this body is obtained as a by-product in gaining silver from argentiferous lead, and is freed from small particles of lead mechanically mixed with it by grinding and washing it. When cold, litharge solidifies into scaly crystalline masses; is used in varnish making to act as a drier, but it forms unstable varnish.

Mastic.— Comes chiefly from the island of Chios, where it is obtained by making incisions in the trunk of the

Pistacia lentiscus. It forms small ovoid and round tears about the size of a pea and flattened, of a light yellow colour, and has an aromatic taste and (when heated) an agreeable smell. The tears which fall from the incision to the ground are the inferior quality, the best being those which adhere to the bark round the incision which is cut transversely. Mastic dissolves in cold spirits of wine, but completely only in boiling alcohol. There has lately been introduced from the East Indies a resin under the name of Bombay mastic, which resembles in some respects the genuine Chios mastic.

Naphtha or **Rock Oil.**—Is a combustible and very volatile liquid resembling turpentine. It is found native, and can be prepared artificially from the distillation of petroleum or coal-tar. It has many uses, and is a very valuable solvent.

Nut Oil.—This oil is obtained from the fruit of the common walnut-tree (*Juglans regia*). The cold-pressed oil differs essentially from that which is obtained later on by using heat. The first is nearly colourless, or at least only slightly yellowish-green, and when fresh has a very pleasant odour and taste; when exposed to the light it becomes perfectly bleached in a short time. Hot-pressed oil is lightly coloured and has a really disagreeable taste and odour. For this reason hydraulic presses are only used for pressing the oil, as these produce the greatest pressure of all presses. As cold-pressed oil commands a higher price, the manufacturers endeavour to obtain the highest pressure by the most powerful presses, so as to be able to gain the greatest part of the oil by cold pressing.

On account of its very light colour nut oil is much liked for the fabrication of very fine varnish and also for thinning colours used in oil-painting.

Oxide of Zinc.—Or zinc white; is used as a drier in the manufacture of fat varnishes. This body is obtained by the combustion of zinc in contact with the air, and forms a brilliant white powder. The zinc white prepared in the

zinc works is a very pure oxide of zinc, and may be used for the fabrication of varnish without further preparation.

Oil of Turpentine.—(Spirit of Turpentine, Essence of Turpentine, Turps, Camphene, Champhine, Terebinthinæ acetum, Spiritus Terebinthinæ, Essentia T., Oleum Terebinthinæ, and T. purificatum, are other names by which this fluid is sometimes designated.)

Commercial oil of turpentine is obtained by distilling strained American turpentine along with water. The residuum in the still is resin or rosin. The product in oil varies from 14 per cent. to 16 per cent. It may be rectified by re-distilling it along with 3 or 4 times its volume of water, observing not to draw over quite all of it. The portion remaining in the retort, balsam of turpentine, is viscid and resinous. A better plan is to well agitate it with an equal measure of solution of potassa or milk of lime before rectifying it. This is the plan adopted for the camphine used for lamps. By agitating crude oil of turpentine with about 5 per cent. of sulphur, and diluted with twice its weight of water, and after repose and decantation rectifying it with 5 or 6 times its volume of the strongest lime-water, a very pure and nearly scentless oil may be obtained.

Pure oil of turpentine is colourless, limpid, very mobile, neutral to test-paper, has an odour neither powerful nor disagreeable when recently prepared, but becoming so by exposure to the air. Hot, strong alcohol dissolves it freely, but the greater part separates in globules as the liquor cools. It congeals at 14° and boils at 312° F. It is extensively used in the manufacture of paints and varnishes. One chief value is its property of diminishing the brittleness of certain lacquers and varnishes.

To prevent accident it is proper to caution the operator of the extremely penetrative and inflammable nature of the vapour of this oil, even in the cold. During the process of distillation, unless the greatest precautions are taken, an explosion is almost inevitable.

When oil of turpentine is inclosed with a large quantity of air in a spacious vessel it becomes viscid by absorbing

oxygen, and acquires by this means an extraordinary bleaching power. Turpentine has a great solving power for resins. It will dissolve the greater part of the resins and leave them behind on evaporating. Hence it is of great value to the varnish maker.

Paraffine Wax.—Is a substance contained in tar, which in a pure state forms a white mass looking like alabaster, and at the present time is frequently used in the manufacture of candles. It is also used for the fabrication of a few lacquers, and serves at the same time to make them less brittle.

Petroleum.—Various suggestions have been made to account for the occurrence of native naphtha. It is most generally believed that the chief cause is the decomposition at great depths beneath the earth's surface of vegetable and animal remains, but it is by no means known with any certainty how this decomposition has been brought about, whether it is still going on, or whether the process has long ceased to be in active operation. Petroleum can rarely be procured without boring wells, from which it is obtained by pumping, or in some cases by means of buckets and windlass. In America, oil boring is very rapidly accomplished.

Professor Dewar states that wells of 1500 to 2000 feet in depth are pierced in from about one to two months. The oil is largely conveyed from the neighbourhood of the wells by pipes, and these pipe-lines have, during the last thirty years, become a great feature of the American oil industry. The oil from many thousand wells is passed through steel pipes, the aggregate length being several thousand miles, worked by various companies.

Petroleum possesses the power of dissolving resins, and of leaving them behind on evaporating. The extraordinarily low price at which this article is brought into commerce, causes it to be well adapted as a practical substitute for the considerably dearer oil of turpentine, and experiments have proved (says Brandt) that *refined* petroleum can be advantageously used instead of oil of turpentine for thinning thick

fat varnishes. In refining petroleum several extraordinarily volatile hydrocarbons are obtained, which are excellent solvents for resins, and for this reason deserve great attention from manufacturers of varnishes. In commerce these substances are found as fluids, clear as water, and are known as kerosene, petroleum-naphtha, and benzol (benzine). Large quantities of the latter are manufactured from coal-tar. As the boiling point of most of the fluids is below 60° C. (140° F.) they must be kept in well closed vessels, and on account of their inflammability the greatest care with fire and light is required. Resins are quickly and easily dissolved in these oils, but the solutions dry slowly under the brush, and when once used must, therefore, be thinned with petroleum, oil of turpentine, or spirits of wine.

To Deodorize Petroleum.—Mix chloride of lime with it in the proportion of 3 ozs. for each gallon of the liquid to be purified. It is then introduced into a cask. Some hydrochloric acid is added, and the mixture is well agitated so as to bring the whole of the liquid into intimate contact with the chlorine gas. Finally, the petroleum is passed into another vessel containing slaked lime, which absorbs the free chlorine, and leaves the oil sufficiently deodorized and purified.

Poppy Oil.—Obtained in considerable quantities from the small black seed of the common poppy plant (*Papaver somniferum*). The seeds are so rich in oil that more than one-half their weight can be gained from them. Poppy oil has a light yellow colour, and on account of its mild agreeable taste, is frequently used for culinary purposes. In the fabrication of lacquers and varnishes it is only used for fine qualities. It is also used by artists for thinning their colours.

Red Lead.—This body is also an oxide of lead, but it is the red oxide, or minium, and contains more oxygen than the common monoxide (*i.e.* litharge) of lead. It is manufactured by carefully heating litharge in contact with the air until this is brought nearly to its point of fusion, but without

allowing the heat to rise to the fusion point of the litharge. The monoxide continues to absorb oxygen from the air, and is gradually changed into a powder of peculiarly red colour, which is used as a paint, and also as a very durable cement for gas and water conduits. Its use to the varnish maker is as a drier of oil.

Saffron.—Consists of the stigma of the saffron plant (*Crocus sativus*), a species of iris, and is especially cultivated in Austria and France. On account of its high price saffron is too frequently adulterated with other vegetable matter, or the colouring matter is partly extracted and the dried substance is again brought into the market. As at the present time many colouring substances are known which form a very good but decidedly cheaper substitute for saffron, but little of the latter is now used for the manufacture of varnishes.

Sandarac.—Is a resin which flows from the bark of a species of cypress (*Callitris quadrivalvis*), which is found in North America and Barbary, and forms tear-like masses of a white-yellow to brown colour, easily fusible in alcohol. It is largely used in making varnishes and lacquers. Sometimes it is called sandarach or juniper resin, which is obtained from the African *Arbor vitæ*. The Turks employ the wood in the construction of their mosques, it being very tough and possessing great lasting qualities. Sandarac resin melts at 130° C. (266° F.), developing then a very aromatic odour; it is only partly soluble in spirits of wine. The so-called German sandarac differs very much in its properties from the genuine, and consists of the resin of the juniper bush (*Juniperus communis*).

Sanders Wood.—*Lignum santali rubrum* or red sanders wood is sometimes confounded with sandal wood. It is the wood of the *Pterocarpus santalinus*, and furnishes a beautiful red colouring matter, whereas the sandal wood is either white or yellow. Sanders wood is brought into the market in large logs, the outside of which have a brownish red appearance, while inside they show a beautiful red

colour. The sanders wood which is brought into the market in the form of chips, is frequently badly adulterated.

Seedlac.—Is a product nearly related to shellac, as is mentioned under shellac ; a red colouring matter exudes with the shellac from certain trees in consequence of injuries inflicted by an insect. Frequently the resin and lac envelope the animal with a coating, the so-called stick lac, from which the resin is gained by heat, while the remaining mass, composed of the bodies of the animals, forms the seedlac. The seedlac should form compact masses of a dark red colour. Besides this seedlac the actual colouring matter, the lac-dye, is gained by boiling it in water, and allowing the fluid to dry up ; good lac-dye has a fiery red colour, very much like cochineal.

Shellac.—This resin flows from the branches of certain East Indian trees, in consequence of injuries inflicted by a species of coccus (*Coccus Lacca*). It hardens at the same time with a very beautiful red colouring matter, which is called lac-dye. The resin, separated from the colouring matter, is shellac, which is found in commerce in different qualities, and is called according to its colour—ruby shellac, blond shellac. Generally shellac has a light yellow-brown or reddish-brown colour, and is easily soluble in strong alcohol. The solution forms a varnish very much used—the so-called cabinet-maker's varnish—for a variety of purposes. By treating the solution of shellac with animal charcoal, or with a solution of chloride of lime, the shellac can be *perfectly bleached to white masses shining like silk.* Bleached shellac is very difficult to dissolve if at all old. The secret of its solution is to use it freshly bleached, therefore the following

Process of Bleaching Shellac will be serviceable to the varnish maker :—Make a solution of 1 lb. of chloride of lime in 1 lb. of water, and mix it with a solution of soda until no more precipitate is formed. Pour off the clear fluid and add $1\frac{1}{3}$ gallon of spirits of wine, solution of shellac, and thoroughly shake. Then let the entire mass stand till it is observed by the colour of the fluid that the bleaching is

done. A half to one hour is about the time this process requires, which is hastened if done under the direct influence of the rays than in a scattered light. The bleached fluid is then poured into a large stoneware pot or enamelled vessel, and hydrochloric acid is added as long as resin is separated. The resin so separated is a very light-yellowish colour, and loses the remaining parts of the colouring matter by washing it in boiling water. The form in which bleached shellac is brought into the market is that resembling skeins of white silk, but for the purpose of the varnish maker there is no need to so fashion it. There are other processes of bleaching this substance, but the above is as good as any.

Shellac is very troublesome to pulverise. The best way is to enclose the shellac in strong cloth, and beat with a hammer or iron pestle. Sift the fine particles out, and continue the operation until all is pulverised.

Sugar of Lead.—Is chemically an acetate of lead or crystallized salt, which is obtained by dissolving litharge in vinegar and by evaporating the solution. The crystals have an intensely sweet taste—hence the name—but a very disagreeable metallic after-taste. They are poisonous like all other lead compounds, and when exposed to the air become covered with a white powder—they effloresce. When sugar of lead is dissolved in water, it may happen that a part of the salt is not dissolved, and the fluid will have a milky appearance. In such a case an insoluble acetate of lead has been formed, but it can be easily dissolved in a short time by adding a small quantity of vinegar to the fluid and heating it. Its use to the varnish maker is as a drier or siccative.

Tar Oils.—Thick, mostly very strong smelling fluids, known as tar, are formed by dry distillation, that is, by heating organic bodies (such as wood, stone coal, and brown coal) in a vacuum. Several solid and fluid products, consisting also of combinations of hydrocarbons and which are principally used for illuminating purposes, are obtained by distilling the tar. The lighter and volatile products of these are fluid, are less valuable for illuminating purposes, but

are especially well adapted for dissolving resins, and are much used for this purpose. In regard to these properties the same holds good that has been said about petroleum, naphtha, and benzol. In commerce, a distinction is made between light and heavy tar oils. The first are less dense and the boiling point is lower than the latter, and they are principally used for manufacturing volatile varnishes and lacquers.

Turmeric.—This body is the root of a plant (*Curcuma longa*) growing in India, China, and Madagascar, and now chiefly cultivated in Bengal as the *Radix curcumæ* of druggists. The roots are long, and vary in thickness from that of a quill to about half an inch in diameter. They are wrinkled, and have joints or ring-like swellings at short intervals. Externally the colour is a yellowish grey, while internally it is of a deep yellowish brown, darkest in the middle. When reduced to powder it is of a bright yellow.

A second variety, *Curcuma rotunda*, forms tubers of the size of a nut, but its properties are the same as those of *Curcuma longa*. The Chinese turmeric is considered the best; the next best is the Japanese, while the Barbadoes turmeric is the poorest quality. The colouring matter of the turmeric is easily soluble in spirits of wine, and has a bright yellow colour, but possesses little durability when exposed to the light.

Turpentine.—This valuable fluid is the product of several trees, principally *Pinus palustris* and *P. tæda*, and other cone-bearing trees (fir, pine, larch). Most of it comes from the United States, generally in large barrels, of the consistency of treacle or honey. The oil is obtained by distillation, and the remainder is the common resin, sometimes called "rosin," which is applied to a variety of uses.

There are several kinds of turpentine, viz., VENICE TURPENTINE, procured from the *Abies larix;* STRASBURG TURPENTINE, from *A. pectinata;* BORDEAUX TURPENTINE, from the *Pinus pinaster;* and CHIO TURPENTINE, from the *Pistacia terebinthis*.

Venice turpentine is yellow, like honey, and viscous, and has a not disagreeable smell. Genuine Venice turpentine is the product of the *Larix Europæa*, but this is now scarcely ever met with in trade. That of the shops is wholly a factitious article, made as follows :—Black resin, 24 lbs.; melt, remove the heat, and add 1 gall. of oil of turpentine.

An imitation or factitious Chio turpentine is made thus :—Black resin, 7 lbs.; melt, remove the heat, and stir in balsam of Canada, 7 lbs. Some add a few drops of the oils of fennel and juniper. This article is very generally sold in the trade for genuine Chio turpentine.

CHAPTER II.

DIRECTIONS FOR THE FILTERING AND BLEACHING OF VOLATILE VARNISHES AND LACQUERS.

The Filtration of Varnishes.—In the following receipts many varnishes are directed to be filtered. As there would be a great loss of the volatile solvent if the filtration were carried on in open funnels, and as such loss would prevent efficient filtration, and also cause the filtered product to be too thick, a simple apparatus like in Fig. 1 is very efficacious in preventing loss of the volatile solvent.

Description of Fig. 1 :—A is a glass jar or bottle with a bung or cork in it, through which pass the neck of the funnel B and a piece of glass tubing attached to the india-rubber tube C. The other end of this flexible tube passes through the wooden cap D by means of another piece of glass tube bent at an angle. D is a wooden cap, on the under side of which is a piece of sheet gutta-percha or a ring of same fitting inside the funnel B so as to render the cap airtight.

The varnish to be filtered is put into the funnel B, on the neck of which is a plug of cotton wool or a cloth or paper filter. As it filters through, the air contained in the jar A is passed through the tube C to the space between the varnish and the cap D ; then an equilibrium is kept up, and at the same time the evaporation of the spirit in the varnish is prevented by means of the cap C.

The Bleaching or Decoloration of Varnishes.—Many varnishes for special purposes require to be absolutely destitute of colour. To render them colourless

varnishes have to be submitted to a special treatment or bleaching process. Animal charcoal is generally the agent used to effect this object, and as the powdered charcoal soon becomes clogged up, rendering the filtering very

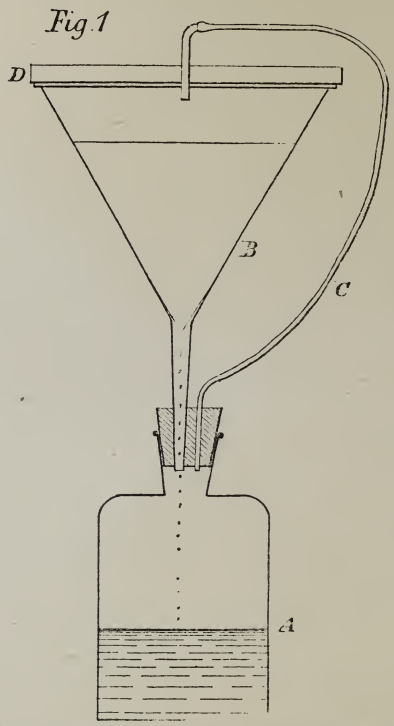

FIG. 1.—Simple Apparatus for the efficient Filtration of Volatile Varnishes, Lacquers, &c.

tedious, the charcoal should be only roughly powdered to the fineness of coarse sand.

As the raw animal charcoal contains salts that are not desirable to bring into contact with the ingredients of a varnish, the charcoal should be treated as follows, previously to using it for the bleaching of them:—

Put about 5 lbs. of raw animal charcoal into a stoneware pot of about $5\frac{1}{2}$ galls. capacity, and pour on it $2\frac{1}{2}$ to $4\frac{1}{2}$ lbs. of raw hydrochloric acid, and allow the entire mass to stand for one day in the covered pot, during which time it should be stirred repeatedly. Then pour out the contents into a tub containing about $6\frac{1}{2}$ galls. of water, and allow the charcoal to settle; then pour off by decantation or syphoning the supernatant fluid, and again pour clean water over it. Repeat this operation until the water comes off entirely free from acidity. This is ascertained by dipping a blue litmus paper into the water; if the blue colour is entirely unchanged, the water is no longer acid, but if the blue colour is ever so slightly reddened or changed, then you know that the water is not free from acidity. When the charcoal has been perfectly washed free of acid, dry it by heat, either by standing it in tins in an oven or before a fire.

The bleaching of a varnish should precede the filtering of same. By connecting the apparatus shown in Fig. 2 the bleaching and filtering can be simultaneously performed; but such an operation is objectionable, inasmuch as it does not readily permit changing of the filtering substances should it lose its efficiency.

Description of Fig. 2 :—The vessel A is placed on a shelf, and contains the varnish to be bleached, through the cork of which is a bent glass tube to allow air to flow into the vessel to prevent the exit of the varnish; or else this tube is connected with the flexible rubber tube described in Fig. 1, if the filtering is performed at the same time that the bleaching process is carried out.

The varnish flows through the tap B into the vessel C, which holds the animal charcoal. The varnish, after passing through the charcoal, is either collected in a vessel or else allowed to flow into the filtering funnel B of Fig. 1, from whence it passes into the receiving jar, bleached and filtered.

The vessel C is woven wire, and rests on a ledge that is formed in the lower part of the vessel D, thus enabling the vessel C to be lifted out for the discharge and renewal of its contents. D is of thin sheet-iron, made in the shape shown, with a lid and funnel-shaped bottom, so as to collect the

bleached varnish as it flows from C and convey it through the neck E, either into a receiving vessel or into the filtering funnel shown in Fig. 1.

If the operations of filtering and bleaching are carried on simultaneously, the upper end of the flexible tube C is

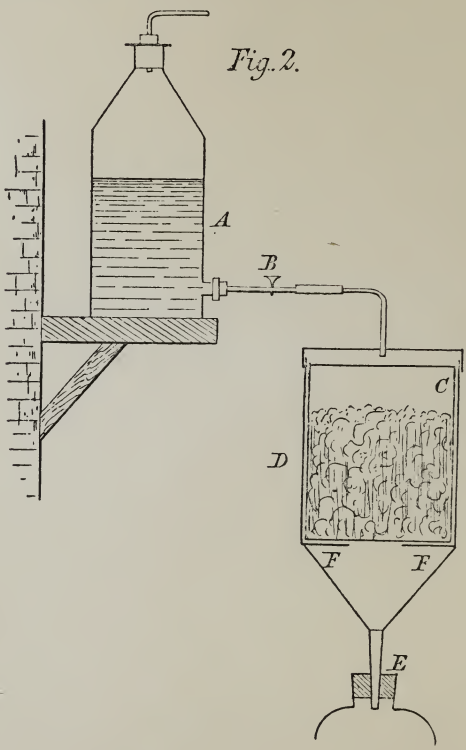

FIG. 2.—Apparatus for the Bleaching of Varnishes.

removed from the cap of B (Fig. 1) and joined with the air-tube that passes through the cork of A (Fig. 2).

As many varnishes require to be filtered while warm, it is best to have the vessels A (in Figs. 1 and 2) of stoneware, and to warm them before putting in the hot varnish. Likewise

the funnel B (Fig. 1) should be of earthenware in preference to glass, although metal will do for most varnishes.

After the filtering and bleaching, the whole apparatus should be thoroughly cleansed by washing with benzine, turpentine, or other solvent, or else strong soda or potash lye. If the latter body be used, every trace of it should be washed away from the apparatus by well rinsing same in plenty of clean water, as should a trace of the alkali remain it will inevitably spoil whatever varnish is next put into the apparatus.

CHAPTER III.

FORMULÆ FOR PREPARING POLISHES FOR WOOD.

Beyond separating the formulæ into polishes, creams, and restorers of woodwork, we do not attempt a further classification into special kinds—*e.g.* polishes for new wood, polishes for stained wood, polishes for carved work, &c.—as we shall give a very full and comprehensive index. The inquirer after any special kind of polish, &c., will be at once able to turn readily to the page on which it is given.

To Make and Use a Polish for Carved Work.

Ingredients.—1 part of seedlac, 1 part transparent resin, 9 parts of spirits of wine.

Method of Preparation.—Dissolve the solids in the spirit by digestion for several hours, with frequent shakings

Method of Use.—Warm the article to be polished in front of a stove, also warm the polish, and then lay it on with a brush; avoid going over the same part more than twice, or the brush marks will show.

A French Polish for Carved Work in Furniture.

Ingredients.—30 parts of shellac, 7 parts of gum-arabic, 15 parts of copal, 700 parts of spirits of wine.

Method of Preparation.—Pound up the resins in a mortar and sift the powder through a piece of muslin or a fine-mesh hair sieve; when all the resins are reduced to fine powder, put it in a capacious flask or bottle, and pour the spirit on it, cork up the bottle, and stand it in a moderately warm

place until the resins are thoroughly dissolved in the spirit. Several days will be required to accomplish this, then strain the fluid through a piece of muslin, then place a piece of muslin into the wide neck of a flask or bottle—a pickle bottle or jar answers very well—press the muslin an inch or two down the neck, and then tie the overlapping edges round the neck with a piece of string. By pouring the polish a little at a time into the hollow of the muslin, it will be strained as it passes through. Where large quantities of the polish are made, the special filtering apparatus (see *ante*) should be used.

Method of Use.—Apply the polish with a soft hair brush to the carved parts; a beautiful gloss and richness of colour at once are given to the carvings.

To prepare a "**finish**" to use after the application of the above polish :—Dissolve 8 parts of shellac and 8 parts of gum benzoin in a bottle with 350 parts of rectified spirits of wine, cork up, and let the mixture digest in a warm place with frequent shakings. When the mixture is fluid and cold, put in a small quantity of the best poppy-seed oil, which should be as clear as water, mix all intimately together, and keep it for use.

Moody's Polish.

Ingredients.—1½ part of shellac, ½ part gum benzoin, and 1$\frac{1}{15}$ part dragon's blood to deepen the colour (this need not be added unless desired), 8 parts of rectified wood spirit (acetone).

Method of Preparation.—Dissolve the ingredients in the spirit by standing the vessel in a warm place, or by the gentle heat of a sand bath, and filter the solution through half worn-out flannel.

Method of Use.—Apply the polish with a camel's hair brush.

A New Polish for Wood.

Ingredients.—3 parts shellac, 100 parts of a solution of collodion cotton, and 50 parts of camphor dissolved in ethyl alcohol.

For a finish, mix benzole and alcohol.

Another Formula (Wholesale) for a Similar Polish.

Ingredients.—6 lbs. shellac, $3\frac{1}{2}$ ozs. high grade sulphuric ether, $3\frac{1}{2}$ ozs. collodion cotton, $1\frac{3}{4}$ oz. camphor, 4 to 5 galls. of pure alcohol, oil of rosemary q.s., pure linseed oil q.s., benzole.

Method of Preparation. — Dissolve the shellac in the alcohol, separately dissolve the collodion in the ether, and add the camphor; stir thoroughly, and stir in enough alcohol of 96 per cent. to completely dissolve the cotton, then mix the two solutions together and shake well.

To prepare an oil for rubbing in the polish, dissolve as much camphor in rosemary oil as the latter fluid will dissolve, and mix $1\frac{3}{4}$ oz. of this mixture with 35 ozs. of pure linseed oil. For a finish, dissolve benzole in alcohol and dilute at pleasure, taking care to apply the solution as weak as practicable.

Polish for Carved Cabinet Work.

Ingredients.—2 ozs. seedlac, 2 ozs. white resin, 1 pint alcohol 90 per cent. strength.

Method of Preparation.—Dissolve the resins in the spirit by gentle heat.

Method of Using.—Warm the article to be polished, if practicable, so as to dry it and drive out all dampness, and then lay the polish on the warm wood, the polish itself being warmed. For standards or pillars of cabinet work, it should be laid on with a brush, while for carved parts it should be used thus :—Varnish the parts with the common wood varnish, and having dressed them off where necessary with emery-paper, apply the above polish.

Renovating Polish for Fine Carved Work.

Ingredients.—8 ozs. linseed oil, 8 ozs. old ale, white of 1 egg, 1 oz. hydrochloric acid, 1 oz. spirits of wine.

Method of Preparation.—Mix, and let digest until all are thoroughly incorporated.

Method of Using.—Shake well before using, and apply a little to the face of a soft linen pad, and lightly rub the pad for a minute or two over the articles to be restored, which must afterwards be polished off with an old silk handkerchief. This polish will keep any length of time, if the bottle be well corked.

Polish for Darkening Furniture.

No. 1. *Ingredients.*—1 pint linseed oil, 1 oz. rose-pink, 1 oz. alkanet root.

Method of Preparation.—Beat the pigment and dye-colour up in a mortar in the oil; then let the mixture rest for a couple of days, and, when clear, pour off the oil, which will be found to be of a rich colour.

No. 2. *Ingredients.*—1 oz. alkanet root, 4 ozs. shellac varnish, 2 ozs. turpentine, 2 ozs. scraped beeswax, and 1 pint of linseed oil.

Method of Preparation.—Mix altogether, and let them digest for fully a week.

Copal Polish.

Ingredients.—4 parts powdered gum copal, 1 part camphor, ether q.s., alcohol q.s.

Method of Preparation.—Melt the copal and camphor in the ether at a gentle heat to form a semi-fluid mass, and then digest with a sufficient quantity of alcohol.

Ordinary Cabinet-maker's Polish for Dark Woods, such as Walnut, Mahogany, &c.

Ingredients.—1 part of ruby shellac, 4 parts of spirits of wine.

Method of Preparation.—Digest the shellac in the spirit.

White Cabinet-maker's Polish.

A colourless polish for light woods, such as maple, ash, boxwood, &c.; also useful to turners, to give a glossy appearance to their work.

Ingredients.—1 part completely bleached shellac,* $4\frac{1}{2}$ to 5 parts of spirits of wine.

Method of Preparation.—Digest the shellac in the spirit.

Dark-coloured Polish.

Ingredients.—$10\frac{1}{4}$ ozs. ruby shellac, 1 oz. Venetian turpentine, 39 ozs. alcohol 96 per cent.

Method of Preparation.—Dissolve the shellac and turpentine in the spirit, and filter through blotting-paper.

Mahogany Polish.

Ingredients—$8\frac{3}{4}$ ozs. of best shellac, $33\frac{1}{2}$ ozs. alcohol 96 per cent.

Method of Preparation.—Put the alcohol and shellac into a bottle or jar; cover its mouth with muslin, or paper pierced with holes, or a cork with a small hole through it; and then effect solution by standing the bottle in a vessel of boiling water.

English Polish.

Ingredients.—$8\frac{3}{4}$ ozs. finest shellac, $2\frac{1}{10}$ ozs. dragon's blood, $26\frac{1}{4}$ ozs. alcohol 96 per cent., $2\frac{1}{10}$ ozs. copal resin powdered, $8\frac{3}{4}$ ozs. alcohol 96 per cent., $6\frac{3}{10}$ ozs. fine chalk in powder.

Method of Preparation.—Powder the shellac and dragon's blood, and dissolve them in the first-named quantity of alcohol; in a second vessel put the copal powder; pour on it the second-named quantity of alcohol, and add the chalk powder to it, and digest this mixture for several days by the heat of a sand bath. When the copal has dissolved, add the saturated solution of copal in alcohol to the first solution; then intimately mix by heating, and finally filter through a filtering bag.

* A trade secret in getting bleached shellac to dissolve is to use it freshly bleached; if at all aged, it is dissolved with difficulty, even though borax be added to the solution.

French Polish.

Ingredients.—4½ ozs. of finest shellac, 1 oz. dragon's blood, 7¾ grs. (troy) of turmeric, 50 ozs. alcohol 96 per cent.

Method of Preparation.—Dissolve the shellac in one-half the prescribed quantity of alcohol, and dissolve the shellac by the aid of a gentle heat—*i.e.* in a sand bath. In a second bottle, the dragon's blood and remainder of alcohol are placed for the resinous matter to dissolve; then pour the two solutions together; when they are mixed, put in the turmeric, shake well, and let the mixture stand undisturbed for twenty-four hours; then filter it.

Vienna Polish.

Ingredients.—3¾ ozs. finest shellac, 17 ozs. alcohol 96 per cent.

Preparation.—Digest at a moderate temperature.

Polish for Wood, used without Friction.

Ingredients.—4 ozs. best shellac, 1 quart strong alcohol, 1 quart linseed oil, 1 pint spirits of turpentine, 4 ozs. sulphuric ether (common ether), 4 ozs. aqua ammonia.

Preparation.—Dissolve the shellac in the alcohol, then add the oil and turpentine, shake well together, and then add the ether and ammonia.

Method of Using.—Shake before use, and apply lightly with a sponge.

Imitation Polish for Woodwork.

Ingredients.—Gelatine solution, 2¼ lbs. fluid copal varnish, 4 drachms pure drying linseed oil, ethereal solution of wax q.s.

Preparation.—Varnish the woodwork with the solution of gelatine, and after it has dried and been smoothed by

rubbing, lay on the mixture of copal varnish and linseed oil; when this is dry, polish the wood with the ethereal solution of wax.

A Red Polish.

Ingredients.—4 ozs. beeswax, 4 drachms alkanet, 16 ozs. oil of turpentine.

Preparation.—Digest the alkanet in the turpentine until the fluid is sufficiently coloured, then scrape the beeswax fine, and thoroughly incorporate all the ingredients by digesting the mixture by the heat of a water bath.

If the alkanet be omitted a pale polish is obtained by this formula.

White Polish.

Ingredients.—1 part white wax, 2 parts solution of potash.

Preparation.—Boil to proper consistency.

White Polish for Light Woods.

Ingredients.—3 ozs. white (*i.e.* bleached) shellac, 1 oz. white gum benzoin, ½ oz. gum sandarac, 1 pint alcohol or wood naphtha.

Preparation.—Dissolve the three solids in the fluid.

A Polish for Satinwood or Maple.

Ingredients.—¼ oz. chrome yellow, 1 gill light French polish.

Preparation.—Mix the two ingredients, and use in the same manner as in using French polish; a little chrome yellow on the rubber is desirable. In French polishing, always use a drop of linseed oil on the rubber.

Polish for Turner's Work.

Ingredients.—1 oz. sandarac resin, 2 gills alcohol 90 per cent., 1 oz. beeswax, spirits of turpentine q.s.

Preparation.—Dissolve the sandarac in the alcohol, shave the wax into as much turpentine as suffices to dissolve it to a paste form, and add the sandarac solution to it gradually by degrees.

Method of Using.—Apply this polish with a woollen cloth to the wood while it is in motion in the lathe, and polish it with a soft linen rag; it will appear as if highly varnished.

Polish for Wainscot.

Ingredients.—Beeswax q.s., 90 per cent. alcohol q.s.

Preparation.—Take as much wax as will be sufficient for the work in hand, put it in a paint-pot, or other earthenware pan, and cover it with the alcohol and allow the wax to dissolve without the aid of heat; add the other ingredients as required to reduce it to the consistency of butter.

Method of Using.—Well rub the mixture into the grain of the wood, and clean it off with clean linen rags; a good gloss is produced on the wood.

CHAPTER IV.

FORMULÆ FOR POLISHING PASTES, CREAMS, AND RENOVATORS, &c.

Household Furniture.

No. 1. *Ingredients.*—1 oz. beeswax, ¼ oz. white wax, 1 oz. Castile soap, 1 pint boiling water, ½ pint turpentine, ½ pint spirits of wine.

Preparation.—Shred the wax and soap very thin; pour the boiling water upon the shavings, and let it become cold; then pour on the turpentine and spirits of wine.

Method of Using.—Put a little on a cloth, rub it into the furniture, and then rub to a polished surface with a woollen cloth.

No. 2. *Ingredients.*—1 oz. pearl ash, 8 ozs. genuine beeswax, 8 ozs. water.

Preparation.—Put all the ingredients into an earthenware jar, and warm the mixture so that it becomes semi-fluid; then add sufficient water to bring it to the consistency of cream.

Method of Using.—Reduce the consistency by adding more water, and then spread it on the wood with a painter's brush; let it dry, and then polish with a hard brush or cloth.

If instead of beeswax, white wax be used, this compound may be used to polish plaster casts, statues, &c.

No. 3. *Ingredients.*—2 quarts linseed oil, 3 pints turpentine, 1 oz. dragon's blood, 1 oz. resin, 1 oz. alum, ½ oz. iodide of potassium, 2 ozs. sulphuric acid (fluid measure), 2 ozs. nitric acid (fluid measure).

Preparation.—Put the oil and turpentine into an earthen vessel; then pulverise the dragon's blood, resin, alum, and potassic iodide to a fine powder; stir the powder slowly into the turpentine and oil, then add the sulphuric acid, slowly stirring continually. Let this mixture stand ten hours, then add the nitric acid; slowly stir the mixture while adding it.

Method of Using.—Apply the composition with a sponge.

No. 4. *Ingredients.*—27 ozs. shellac, 7 pints alcohol, $6\frac{1}{4}$ drachms gun-cotton; $6\frac{1}{4}$ drachms of high grade sulphuric ether, 38 drachms camphor, alcohol 96 per cent. q.s., rosemary oil q.s., benzol q.s.

Preparation.—Dissolve the shellac in the first quantity of alcohol; separately dissolve the gun-cotton in the ether, together with the camphor and enough alcohol to completely dissolve the mass; then mix the two solutions.

This polish is finally rubbed up with pure linseed oil; to 100 parts of it 5 parts of a saturated solution of camphor in oil of rosemary are then added; a very dilute solution of benzole in alcohol is used for polishing off.

No. 5. *Ingredients.*—2 quarts soft water, 2 ozs. soap, 8 ozs. white wax in shavings, 1 oz. pearl ash.

Preparation.—Boil the ingredients, except the pearl ash, which is added after; then dilute the compound with water.

Method of Using.—Put the composition on the furniture with a paint brush, and polish off with a cloth or a hard brush.

No. 6. *Ingredients.*—6 ozs. potash, 4 ozs. virgin wax, 1 quart hot water.

Preparation.—Boil the whole for half-an-hour, then stand to cool. Remove the wax from the surface. Put it into a mortar and triturate it with a marble pestle, adding sufficient soft water to form a soft paste.

Method of Using.—Lay the composition on the furniture neatly, and when dry, carefully rub with a woollen rag until a brilliant polish is attained.

No. 7. *Ingredients.*—1 oz. pure beeswax, 2 ozs. linseed oil, 1 pint turpentine.

Preparation.—Melt the wax and oil, and when it has cooled somewhat, put in the turpentine and thoroughly incorporate all the ingredients. Instead of turpentine, soda may be used, but the first is preferable. Then dissolve the soda in hot water, add the wax in small pieces, and mix well over the fire.

Formulæ for Furniture Creams or French Polishes.

No. 1. *Ingredients.*—1 pint alcohol 90 per cent., ¼ oz. copal resin, ¼ oz. of gum-arabic, 1 oz. shellac.

Preparation.—Pound up the resin and gum, and sift through a hair sieve. Then place the powder in a bottle with the spirit and cork up tightly; place the bottle near a warm stove, shake it occasionally, and when the solution is complete—in about 3 days—strain through a piece of muslin as already described. Keep in a tightly corked bottle.

No. 2. *Ingredients.*—6 ozs. shellac, 1 quart naphtha, ¾ oz. gum benzoin, 1 oz. sandarac resin.

Preparation.—Dissolve the solid ingredients in the spirit.

No. 3. *Ingredients.*—1½ oz. shellac, ¼ oz. sandarac, ½ pint naphtha.

Preparation.—Dissolve the solids in the spirit.

Method of Using.—Make a pad of flannel, wet it well with the polish, then lay a piece of clean linen rag over the flannel, apply 1 drop of linseed oil, rub the work in a circular direction lightly at first. To finish off, use a little naphtha, applied the same as the polish.

No. 4. *Ingredients.*—9 ozs. shellac, ¾ oz. mastic, ¾ oz. sandarac, 1 quart spirits of wine, 1 gill copal varnish.

Preparation.—Dissolve the three solids in the spirit, and then add the copal varnish and thoroughly mix by agitation.

No. 5. *Ingredients.*—12 ozs. shellac, 1 quart wood naphtha, ½ pint linseed oil.

Preparation.—Dissolve the shellac in the naphtha, and then add the oil.

No. 6. *Ingredients.*—3 ozs. shellac, ½ oz. mastic resin, 1 pint methylated spirit.

Preparation.—Dissolve the solids.

No. 7. *Ingredients.*—5 ozs. shellac, ½ oz. gum elemi, ¾ oz. gum copal, 1 quart methylated spirit.

Preparation.—Dissolve the resin in the spirit by digestion.

No. 8. *Ingredients* —2½ ozs. shellac, 1 oz. gum juniper, 1 oz. gum benzoin, 1 pint methylated spirit.

Preparation.—Dissolve.

No. 9. *Ingredients.*—1 oz. mastic resin, 1 oz. sandarac resin, 1 oz. seedlac, 1 oz. sandarac, 1 oz. shellac, and 1 oz. gum-arabic, ¼ oz. virgin wax, 1 quart methylated spirits of wine.

Preparation.—Reduce the solids to powder, and then digest them in the spirit in a closed bottle for twelve hours, when it will be fit for use.

No. 10. *Ingredients.*—1 oz. gum lac, 2 drachms mastic in tears, ½ oz. sandarac, 3 ozs. shellac, ½ oz. gum-dragon.

Preparation.—Reduce the whole to powder and dissolve in water.

No. 11. *Ingredients.*—4 ozs. yellow wax, 2 ozs. yellow soap, 50 ozs. water, 5 ozs. boiled oil, 5 ozs. oil of turpentine.

Preparation.—Dissolve the wax and soap in the water by boiling and constantly stirring, then add the oil and turpentine.

No. 12. *Ingredients.*—8 ozs. white wax, cut up in shavings, 2 ozs. soap, 2 quarts soft water, 2 ozs. pearl ash.

Preparation.—Boil the soap and wax in the water; add the pearl ash.

Method of Using.—Dilute the mixture with water, lay it on with a paint brush, and then polish off with a hard brush or cloth.

No. 13. *Ingredients.*—3 ozs. wax, 2 ozs. pearl ash, 6 ozs. water, 4 ozs. boiled oil, 5 ozs. spirits turpentine.

Preparation.—Heat the wax, pearl ash, and water together, and then add the oil and turpentine.

No. 14. *Ingredients.*—6 ozs. raw linseed oil, 3 ozs. white wine vinegar, 3 ozs. methylated spirit, ½ oz. butter of antimony.

Preparation.—Mix the vinegar with the linseed oil by degrees, and shake well so as to prevent separation; then add the spirit and antimony salt and mix thoroughly.

No. 15. *Ingredients.*—1 pint boiled linseed oil, 4 ozs. yellow wax, alkanet root.

Preparation.—Melt the wax in the oil by warming the two together in an earthenware pipkin, and colour with the alkanet root.

No. 16. *Ingredients.*—2 drachms acetic acid, ½ drachm oil of lavender, 1 drachm rectified spirit, 4 ozs. linseed oil.

Preparation.—Mix.

No. 17. *Ingredients.*—1 pint linseed oil, 2 ozs. rectified spirit, 4 ozs. butter of antimony.

Preparation.—Mix.

No. 18. *Ingredients.*—1 pint linseed oil, 2 ozs. alkanet root, 1 oz. lac varnish.

Preparation.—Heat the root in the oil, and then add the varnish.

Formulæ for Furniture Oils.

No. 1. *Ingredients.*—1 pint furniture oil, ½ pint spirits of turpentine, ½ pint vinegar.

Preparation.—Mix altogether.

Method of Using.—Wet a woollen rag with the liquid, and rub the wood the way of the grain, then polish with a piece of flannel and soft cloth.

No. 2. *Ingredients.*—3 or 4 pieces of sandarac resin, each about as large as a walnut, 1 pint boiled oil, 1 drachm Venice turpentine, oil of turpentine (if needed).

Preparation.—Melt the sandarac in the dry state by powdering it and melting the powder in a dry earthenware pipkin, then add the oil and boil together for one hour; while cooling, put in the Venice turpentine, and if too thick, add a little oil of turpentine.

Method of Using.—Apply this compound all over the furniture, and after some hours rub it off; rub the furniture daily without applying fresh varnish, except about once in two months. The polish produced by this mixture is not injured by water, and any stain or scratch may be again covered, which cannot be done with French polish.

No. 3. *Ingredients.*—8 ozs. beeswax, ¼ oz. alkanet root, ½ gill of linseed oil, ½ gill spirits of turpentine.

Preparation.—Melt the beeswax and alkanet root, and keep the wax fluid until well coloured, then add the oil of turpentine, and strain the whole through a piece of coarse muslin.

No. 4. *Ingredients.*—½ gill French polish, ¼ oz. best dragon's blood.

Preparation.—Well mix and strain through muslin.

Method of Application.—The wood having been stained, paper off smooth with No. 0 glass-paper, enough to give an even surface, and apply the polish in the usual manner. If wanted very dark, apply a little dragon's blood to the rubber, but the rubber must be covered twice with linen rag.

No. 5. *Ingredients.*—1 pint of boiled linseed oil, 2 pints alcoholic shellac varnish.

Preparation.—Mix well together.

Method of Application.—Shake well before using, and apply in small quantities with a cloth, and rub the work vigorously until the desired polish is secured.

Revivers and Renovators.

French Polish Reviver.

No. 1. *Ingredients.*—½ pint of linseed oil, 1 oz. camphor, 2 ozs. vinegar, ½ oz. butter of antimony, ¼ oz. spirits of hartshorn.

Preparation.—Mix.

No. 2. *Ingredients.*—½ gill vinegar, 1 gill spirits of wine, 1 drachm linseed oil.

Preparation.—Mix.

No. 3. *Ingredients.*—16 ozs. naphtha, 4 ozs. shellac, ¼ oz. oxalic acid, 3 ozs. linseed oil.

Preparation.—Put the shellac and acid into the naphtha, and let it stand till dissolved, then add the oil.

Compound for Cleaning and Re-polishing old Furniture.

Ingredients.—2 ozs. white or yellow wax, 4 ozs. pure turpentine.

Preparation.—Place an earthenware pipkin over a moderate fire, and into it dip the wax, and when that is melted, add the turpentine (removing the vessel from the fire to prevent ignition of the vapour given off by the turpentine becoming heated); stir the mixture until cool, when it is ready for use. The compound brings out original colour of the wood, adding a lustre equal to that of varnish.

A Good Varnish.

Ingredients.—10 ozs. pale raw linseed oil, 5 ozs. lac varnish, 5 ozs. wood spirit.

Preparation.—Mix, and shake before using.

Pastes for Polishing or Finishing Wood to keep Wood Light.

No. 1. *Ingredients.*—Digest 4 ozs. beeswax cut up fine in 2 gills turpentine.

To darken the wood, add linseed oil to the above.

No. 2. *Ingredients.*—6 ozs. pearl ash, 1 quart hot water, 4 ozs. white wax.

Preparation.—Put the pearl ash in the hot water, add the wax, and simmer for 1 hour in a pipkin, then take the vessel off the fire and let the contents cool; the wax will float; this is taken off and worked into a paste with a little hot water.

No. 3. *Ingredients.*—Beeswax, spirits of turpentine, linseed oil, equal parts.

Preparation.—Melt altogether and allow to cool.

No. 4. *Ingredients.*—4 ozs. beeswax, 10 ozs. turpentine, alkanet root to colour.

Preparation.—Melt and strain.

No. 5. *Ingredients.*—2 drachms alkanet root in 20 ozs. turpentine, 4 ozs. yellow wax in shavings.

Preparation.—Digest the root in the turpentine till coloured enough, then add the wax and place in a water bath and stir till the mixture is complete.

No. 6. *Ingredients.*—6 ozs. linseed oil, 16 ozs. beeswax, ½ oz. alkanet root, 5 ozs. turpentine.

Preparation.—Add the turpentine to the other ingredients when in the melted state, strain and cool.

No. 7. *Ingredients.*—4 ozs. beeswax, 1 oz. resin, 2 ozs. oil of turpentine, Venetian red q.s.

Preparation.—Digest the wax and resin in the turpentine at a gentle heat by means of a sand or water bath, and add the red pigment to colour.

No. 8. *Ingredients.*—16 ozs. white wax, 1 oz. black resin, 1 oz. alkanet root, 10 ozs. linseed oil.

Preparation.—Mix.

No. 9. *Ingredients.*—16 ozs. yellow wax, 2 ozs. yellow soap, 1 quart spirit of turpentine, 1 quart boiling water.

Preparation.—Melt the wax and soap over a slow fire, add the turpentine, and lastly stir in the water gently till it is quite cold.

No. 10. *Ingredients.*—12 ozs. beeswax, 1 quart spirit of turpentine, 4 ozs. common soap, 1 quart water.

Preparation.—Dissolve the wax in the turpentine by putting it in a jar with a cover to it, and standing the jar in a saucepan of hot water (*i.e.* a water bath), separately dissolve the soap in the water, then mix the two fluids and stir well together till nearly cold.

No. 11. *Ingredients.*—5 ozs. yellow wax, 1 pint turpentine, 1½ oz. Castile soap, 2 ozs. water.

Preparation.—Cut the wax in small pieces and dissolve it in the turpentine by a gentle heat; dissolve the soap in the water, and when the turpentine and wax mixture is nearly

cold, mix the two compounds together and stir until the mixture becomes thick.

No. 12. *Ingredients.*—2½ ozs. of yellow wax, 1 oz. white wax, 1 oz. Castile soap, 10 ozs. turpentine, 10 ozs. boiling water, 1 drachm carbonate of potash.

Preparation.—Melt the wax and turpentine together, dissolve the soap and potassic carbonate in the water, and mix while warm, stirring till cold.

No. 13. *Ingredients.*—2½ lbs. stearine, 3½ lbs. oil of turpentine, ¼ oz. ivory or bone black.

Preparation.—Beat the stearine out into thin sheets with a woollen mallet and mix it with the turpentine, after which subject the mass to the heat of a water bath and heat up; when hot, put in the black pigment, at the same time stir well to prevent crystallization. To cool the mixture, empty into another vessel and stir until cold.

Method of Application.—Warm the composition until it is reduced to the liquid state, and apply in small quantities with a cloth; afterwards rub it well with a piece of silk or linen cloth to bring up the polish.

No. 14. *Ingredients.*—6 ozs. linseed oil, 3 ozs. acetic acid, ½ oz. butter of antimony, 3 ozs. methylated spirit.

Preparation.—Mix the oil and acid together and stir well, then put in the antimony salt, and add the spirit last. This composition is known as Derby Cream.

No. 15. *Ingredients.*—1 oz. soap, 4 ozs. beeswax in shavings, ½ oz. pearl ash, 1 quart of water.

Preparation.—Boil the soap, wax, and water together, then add the pearl ash, and stir well.

Method of Application.—Dilute the compound with water, lay it on with a paint brush, and polish off with a hard brush or cloth.

No. 16. *Ingredients.*—3 ozs. wax, 2 ozs. pearl ash, 4 ozs. boiled oil, 5 ozs. turpentine, 6 ozs. water.

Preparation.—Heat the wax, pearl ash, and water together, and then add the oil and turpentine.

No. 17. *Ingredients.*—1 oz. white or yellow wax, 4 ozs. oil of turpentine.

Preparation.—Dissolve by gentle heat.

No. 18. *Ingredients.*—1 gill rain-water, 1 gill spirits of wine 90 per cent., 1 oz. beeswax, 1 oz. pale yellow soap.

Preparation.—Cut the wax and soap into thin slices and boil them in the rain-water until dissolved. Take the vessel off the fire and occasionally stir until cold; afterwards add the alcohol and put up in bottles. It is ready for use at once.

Method of Application.—Apply with a piece of flannel and afterwards rub with a soft cotton cloth.

CHAPTER V.

POLISHING AGENTS FOR METALS.

Polishing Soap.

No. 1. *Ingredients.*—11½ parts of liquid cocoanut-oil soap (*supra* for directions to make), 1 part of tripoli, ½ part alum, ½ part tartaric acid, ½ part white lead.

Preparation.—Stir all the ingredients into the fluid soap.

No. 2. *Ingredients.*—40 parts cocoanut oil, 2 parts lye of 38° to 40° strength, 5 parts colcothar, 5 parts water, $\frac{1}{40}$th part spirits of sal-ammoniac.

Preparation.—Stir the oil into the lye, and, when bright, add the colcothar mixed up in the water, and finally add the spirit of sal-ammoniac to the whole mixture.

No. 3. *Ingredients.*—11 lbs. cocoanut soap, water q.s., 13¼ ozs. of chalk, 6½ ozs. of alum, 6½ ozs. tartaric acid, 6½ ozs. white lead (*i.e.* carbonate of lead).

Preparation.—Cut up the soap into shavings, and melt in water; then add the other ingredients, and stir altogether vigorously.

Polishing Powder.

No. 1. *Ingredients.*—5 parts carbonate of magnesia, 5 parts carbonate of lime, 8¾ parts ferric oxide.

Preparation.—Mix thoroughly, by sifting through a sieve.

No. 2. *Ingredients.*—5 lbs. carbonate of magnesia, 6⅞ ozs. colcothar (washed).

Preparation.—Mix as before.

No. 3. *Ingredients.*—Finely-ground glass, small quantity dried soda ash.

Polishing Paste for Nickel.

Ingredients.—Chalk, mixed with tallow.

Parisian Polishing Powder.

Ingredients.—5 parts jeweller's rouge, 30 parts carbonate of magnesia, alcohol q.s.

Preparation.—Mix into a paste with the spirit, and use wet, rubbing until the paste dries off.

Plate Powders.

No. 1. *Ingredients.*—Sub-carbonate of iron, precipitated and prepared chalk, equal parts.

No. 2. *Ingredient.*—Oxalate of iron calcined.

No. 3. *Ingredients.*—Calcined sulphate of iron, mixed with a little powdered chalk.

No. 4. *Ingredients.*—(Polishing cloth.)—2 ozs. hartshorn powder, 1 pint water.

Preparation.—Boil the powder in the water; then soak small squares of damask cloth in the liquid; hang them up to dry and they will be ready for use, and better than many powders.

No. 5. *Ingredients.*—8 ozs. prepared chalk, 2 ozs. spirits of turpentine, 1 oz. alcohol, ½ oz. spirits of camphor, 2 drachms aqua ammonia.

Preparation.—Add the chalk gradually to the mixture of turpentine, alcohol, spirits of camphor, and liquid ammonia.

Method of Application.—Apply the mixture with a sponge, and polish off when it has dried.

No. 6. *Ingredients.*—1 oz. fine chalk, 2 ozs. cream of tartar, 1 oz. rotten stone, 1 oz. red lead, ¾ oz. alum.

Preparation.—Pulverise together in a mortar.

Method of Application.—Wet the mixture; rub it on the silver, and, when dry, rub it off with a dry flannel, or clean with a small brush.

No. 7. *Ingredients.*—4 ozs. spirits of turpentine, 2 ozs. 90 per cent. alcohol, 1 oz. spirits of camphor, ½ oz. spirits of ammonia, 1 lb. whiting finely powdered.

Preparation.—Mix all the fluids together; then add the whiting, and stir till the whole is of the consistency of thick cream.

Method of Application.—Lay on the preparation with a clean sponge, covering the silver with it so as to give it a coat like whitewash. Set the silver aside until the paste has dried into a powder; then brush it off, and polish with chamois leather.

French Plate Powder.

No. 1. *Ingredients.*—1 part jeweller's rouge, 12 parts carbonate of magnesia.

No. 2. *Ingredients.*—2 ozs. finely-powdered putty powder, 10 ozs. levigated chalk.

No. 3. *Ingredients.*—Common salt, alum, cream of tartar, equal parts.

Preparation and Use.—Dissolve the ingredients in hot water, and boil the plate in it.

Putz Pomade.

No. 1. *Ingredients.*—100 parts common yellow vaseline, or lard melted, 20 parts fine colcothar stirred in.

No. 2. *Ingredients.*—20 parts of American mineral oil, 5 parts of lard, 25 parts fine colcothar.

Preparation.—Melt the lard, and mix with the oil; then stir in the red pigment.

No. 3. *Ingredients.*—1 part oxalic acid, 25 parts oxide of iron, 20 parts rotten stone, 60 parts palm oil, 4 parts vaseline.

Preparation.—Mix the vaseline and oil by heating together, and stir with other ingredients. The iron oxide and rotten stone must be perfectly free from grit.

Polish for Silver-plated Ware.

No. 1. *Ingredients.*—$\frac{1}{4}$ oz. potassic cyanide, 5 grains argentic nitrate, 2 ozs. water.

Preparation.—Dissolve the cyanide and nitrate in the water.

Method of Application.—Apply with a soft brush, dry with a cloth and with a chamois-skin.

Soaps for Silver.

Ingredients.—8 ozs. hard soap, $1\frac{1}{2}$ oz. turpentine, 4 ozs. water, 3 ozs. liquor ammonia.

Preparation.—Mix the turpentine and water, and boil the soap down until perfectly dissolved; then add the liquid alkali.

English Silver Soap.

No. 1. *Ingredients.*—10 parts Castile soap, 10 parts of water, 30 parts of whiting.

Preparation.—Dissolve the soap in the water, and then stir in the whiting.

No. 2. *Ingredients.*—10 parts tripoli, 5 parts of rouge, 15 parts pulverised chalk.

Preparation.—Prepare as in No. 1.

Polishing Powder for Specula (Lord Ross's Formula).

Precipitate a dilute solution of sulphate of iron by ammonia in excess; wash the precipitate; press in screw press until nearly dry, then expose to heat until it appears a dull red colour in the dark.

Window Polishing Paste.

Ingredients.—90 parts prepared chalk, 5 parts white bole, 5 parts Armenian bole, 50 parts water, 25 parts alcohol.

Preparation.—Mix the spirit and water, and then rub up the chalk and boles to a smooth paste.

Method of Application.—Put the paste over the window, allow it to dry, and then rub off with cloths.

CHAPTER VI.

MISCELLANEOUS POLISHING COMPOUNDS.

Magic Polish for Brass.

Ingredients.—20 parts sulphuric acid, 10 parts pulverised bichromate of potash.

Preparation.—Mix the two ingredients and dilute with water equal in weight to the acid and potash salt.

Method of Application.—Apply well to the brass, wash well in water, immediately wipe dry, and polish with rotten stone.

Harness Polish.

Ingredients.—4 ozs. glue, 6 gills vinegar, 2 ozs. gum-arabic, 2 gills black ink, 2 drachms of isinglass.

Preparation.—Break the glue in pieces, put it in a basin, and pour over it about two-thirds of the vinegar; let it stand until it becomes perfectly soft. Put the gum-arabic in another vessel with the ink until it is entirely dissolved; melt the isinglass in as much water as will cover it, which may be easily done by placing the cup containing it near the fire about an hour before it is wanted for use. To mix them, pour the remainder of the vinegar with the softened glue into a dish over a moderate fire, stirring it until it is entirely dissolved, being careful not to let it reach the boiling point, that it may not burn the bottom—about 182° F. being the best heat; next add the gum, let it arrive at about the same heat, and then add the isinglass. Take it from the fire and pour it off for use.

Method of Application.—Put as much as required into a

saucer, heat sufficiently to make it fluid, and apply a thin coat with a dry sponge. If the article is dried quickly either in the sun or by the fire, it will show the better polish.

Polishing Powder for Optical Lens.

Ingredient.—Ferric oxide.

Preparation.—Heat ferrous oxalate until it is converted into ferric oxide. This is used as ordinary polishing powders.

Polishing Powder for Plate Glass Mirrors, &c.

Ingredients.—Calcined magnesia, pure benzine.

Preparation.—Moisten the magnesia with the benzine so as to make a paste sufficiently wet that when pressed a drop will exude from it. Pure benzine being very volatile—it boils at 177 or 178° F.—the mixture should be kept in glass bottles with ground stoppers.

Method of Application.—Put some of the wet paste on raw cotton and rub the glass with it.

"Serviette Magique."

These polishing cloths consist of calico prepared with Castile soap and rotten stone, and dyed with a solution of coralline in alcohol.

English Polishing Paste for Metals.

Ingredients.—Rotten stone, soft soap, oil of turpentine.

Preparation.—Sift the rotten stone through fine muslin or a hair sieve and then knead with a sufficient quantity of soft soap to form a stiff paste. To every 8 ozs. of this mass add $1\frac{3}{4}$ fluid ozs. of oil of turpentine. Put up in boxes or form into balls, which soon become hard.

Method of Application.—Remove all grease and dirt from the articles that are to be polished; moisten some of the parts with water, apply it to the metal and rub with a dirty rag, when a beautiful lustre will be the result. For polishing domestic articles this preparation is excellent.

French Polish for Metals.

Ingredients.—1 part ferric oxide, 50 parts carbonate of magnesia. Mix.

Method of Application.—Moisten a rag with water or alcohol; dip it into the powder, rub the articles thoroughly, and dry them with soft leather.

Polishing Paste for Metal, Glass, &c.

Ingredients.—1 part of olive oil, 1 part of spirit of sal-ammoniac, 2 parts of lime, and 1 part of water, to a thick paste.

Wabeck's Formula for a Polishing Wax.

Ingredients.—4 parts of yellow wax, 1 part of resin, 2 parts of best oil of turpentine.

Preparation.—Melt the wax and stir in the resin, then take it from the fire and pour in the turpentine. Pour the mass into moulds.

Method of Application.—Apply a little of it on a woollen rag, and rub the wood furniture.

Polish for Renovating Old Oak Furniture.

Ingredients.—Wax, sugar, beer.

Preparation.—Boil the wax and sugar in the beer.

Method of Preparation.—Wash all grease-stains, &c., off the furniture with warm beer, then lay the above mixture on with a brush, and when dry rub until the article shows the desired lustre.

Polishing Powder for Silverware, &c.

Ingredients.—4 parts washed pipeclay, 1 part purified tartar.

Preparation.—Mix.

Magnus's Polish (Patent) for Slate.

Ingredients.—7 parts of linseed oil, 1 part ground ochre, 3 parts of tar oil, 1 of asphaltum.

Preparation.—Mix intimately.

Method of Application.—Apply the mixture to the surface of the slate by means of a brush, then submit the article to the heat of about 200° F. When it is cooled off polish with pumice-stone and tripoli.

A Good Polishing Wax for Furniture.

Ingredients.—3 parts oil of turpentine, 4 parts white wax, 2 parts strong alcohol.

Preparation.—Pour the turpentine over the wax in an earthenware vessel; cover the vessel tightly with strong paper, and place it in warm water at the back part of a warm stove to melt the wax. When both substances are melted let the mixture cool until it begins to be solid and assumes a whitish colour, then add and mix with it the alcohol.

Another Polishing Wax for Furniture.

Ingredients.—8 parts white wax, 2 parts of resin, ½ part Venetian turpentine, 6 parts of rectified oil of turpentine.

Preparation.—Melt the wax and Venetian turpentine and resin over a moderate fire, and pour the compound while warm into a suitable earthenware pot, and then stir in the oil of turpentine. In twenty-four hours the polish will have assumed the consistency of soft butter, and is then ready for use.

Method of Application.—Carefully cleanse the furniture with soap-water, and when dry apply the polish in a thin layer with a woollen rag, rubbing first gently and then more vigorously; then let the furniture stand for a quarter to half hour, and rub over more thoroughly with a woollen cloth.

Cleansing Rag for Polishing Metals.

Ingredients.—20 parts dextrine, 20 parts oxalic acid, 20 parts logwood decoction, tripoli powder, pumice-stone powder.

Preparation.—Dip flannel rags into a solution made by

mixing the above ingredients, using them gently, and sift over them a mixture of finely-powdered tripoli and pumice-stone. Place the moist rags upon each other, placing a layer of the powder between each two; then press, take them apart, and dry.

Furniture Renovator.

Ingredients.—1 lb. olive oil, 1 lb. refined oil of amber, 1 oz. tincture of henna.

Preparation.—Mix, and keep in well-stoppered bottles.

Method of Application.—Apply the mixture with a tuft of raw cotton, and rub dry with a cotton rag.

Liquid Polish for Silver-plated Ware.

Ingredients.—3 to 4 drachms potassic cyanide, 8 to 10 grains of nitrate of silver in 4 ozs. of water.

Preparation.—Dissolve the potash and silver salts in the water.

Method of Application.—Apply with a soft tooth-brush; wash the object thoroughly with water, dry with a soft linen cloth, and polish with a chamois-skin. In the case of solid silver some precipitated chalk is allowable in the solution. Neither whiting nor powder of any kind should be used for cleaning and polishing; they only wear out or scratch the silver.

Mem.—For preserving the lustre of silver or plated ware when not needed for actual use for a considerable time, a coating of collodion is carefully applied by means of a brush, so as to cover the surface thoroughly and uniformly. It is used most conveniently when diluted with alcohol, as for photographic purposes.

Polishing Soap for Silver and Brass Articles.

Ingredients.—50 parts of cocoanut oil, 75 to 80 parts of 23° soda, 10 parts tripoli, 5 parts alum, 5 parts cream of tartar, 5 parts white lead.

Preparation.—Mix the oil and soda together and boil

until of a clear jelly. When the soap thus prepared is ready and sufficiently solidified, add the other ingredients, all previously finely pulverised and intimately mixed. Pour the mixture into small shallow tin moulds, and it will quickly solidify.

Method of Application.—Moisten the articles with lukewarm water with a brush, and apply the soap with a rag.

A Second Recipe for a Polishing Soap.

Ingredients.—Commercial colcothar, 6½ lbs. of cocoa soap (made by mixing and boiling cocoanut oil and soda, as in above recipe) cut up fine and dissolved in soft water, 5½ ozs. purified ammonium carbonate.

Preparation.—Wash the colcothar six or eight times in water, and then dry it and mix 8 ozs. of this washed colcothar, rubbed up in a little water, with the ammonium carbonate finely powdered, and add the soap solution with constant stirring. Keep the soap thus prepared in stone jars closed with oiled paper.

A Third Recipe for a Polishing Soap.

Ingredients.—14 ozs. Marseilles soap, 2 quarts water, 7 ozs. finely-pulverised chalk dissolved in water, a little fuchsine to colour.

Preparation.—Dissolve the soap in water, and add the solution of pulverised chalk; colour red with the dye, and keep in stone jars.

Method of Application.—Apply with a leather or woollen rag.

Polishing Paste.

Ingredients.—7 ozs. beef marrow, 3 ozs. fine colcothar, oil of almonds q.s.

Preparation.—Melt the marrow (lard may be substituted) and mix the red pigment with it, and perfume with the essential oil; then pour into small tin moulds.

Method of Application.—Apply the paste with a soft rag; rub thoroughly, and finish with a dry rag.

Formula for Longet's Polishing Powder for Gold Workers.

Ingredients.—4·3 parts white lead, 17·4 parts chalk, 1·7 part of carbonate of magnesia, 4·3 parts of alumina, 2·6 parts of silica, 1·7 part ferric oxide.

Preparation.—Reduce all the ingredients to a fine powder; dry, and then mix and sift through a fine hair sieve to thoroughly incorporate altogether.

Emerson's Polishing Compound.

This preparation is for polishing and cleaning glass, silver plate, tinware, and surfaces that permit only slight friction and but little action.

Ingredients.—4 ozs. water, 1 oz. carbonate of ammonia, 16 ozs. Paris white, aniline q.s. for colouring.

Preparation.—Mix. The product is a solid, which can be put into moulds. As the Paris white consists of white lead, it should not be used upon the inside of culinary vessels.

Polishing Powder for Gold.

No. 1. *Ingredients.*—18 parts of chalk, 5 parts of tale, 2 parts of silica, 2 parts of alumina, 2 parts of carbonate of magnesia, and 2 parts of jeweller's rouge.

Preparation.—Mix, by putting all into a fine sieve or piece of muslin, and sifting.

No. 2. *Ingredients.*—5 parts rock alum burned and finely powdered, 1 part levigated chalk.

Preparation.—Mix, and apply with a dry brush.

Polishing Compound for Gold and Silver Lace.

Ingredients.—1½ oz. shellac, ½ drachm dragon's blood, ½ drachm turmeric root, alcohol q.s.

Preparation.—Put the solids into a bottle and digest in the alcohol; let it settle, and then pour off the ruby-coloured tincture thus obtained.

Method of Application.—Brush the composition over the lace, spangles, clasps, knots, &c., to be polished; and after coating them with the composition, pass a warm flat-iron gently over the objects so as to heat them only very slightly. This composition is useful also for gold embroidery. Brush off with a jeweller's polishing brush.

Composition for Polishing Silver Lace or Embroidery.

Preparation.—Strongly ignite alabaster, and while it is still hot place it in corn brandy; a white powder will be then obtained, which is fit to use after heating over the flame of a spirit lamp.

Method of Preparation.—Dust it on from a linen bag, and well brush off afterwards.

Polishing Powder for Gold Workers.

Ingredients.—21½ parts carbonate of lead, 87 parts carbonate of lime (chalk), 8½ parts carbonate of magnesia, 21½ parts alumina, 13 parts silica, 8½ parts jeweller's rouge.

Preparation.—Mix altogether.

CHAPTER VII.

PRACTICAL DIRECTIONS FOR POLISHING WOOD.

"French polishing is the name given to the art of coating wood with a fine smooth glossy surface or varnish of shellac, and various other gums which are easily soluble in 90 per cent. alcohol, methylated spirits, or wood naphtha. A varnish is thus produced; but if it is applied simply with a brush, as copal, mastic and most other varnishes are applied, the result is a very broken and uneven surface, instead of a smooth and continuous polish. To obtain a good polish with a lac varnish, it is necessary to apply a very small quantity at once, and to rub it continuously until it dries; when this process has been carefully and properly gone through, the result is a beautiful and even surface, which is not to be surpassed, or even equalled, by any other means.

"**Rubbers.**—The small pliable rubbers employed for doing carved frame-work, &c., are usually made of white wadding; and the large round ones, used for surface work, are mostly formed of soft flannel. The latter kind must be firmly made, and the more they possess such qualifications as proper size and solidity, the more quickly and satisfactorily will they polish extensive surfaces.

"**Rags.**—Fine linen makes the best rubber coverings and spirit cloths, but cheap cotton will answer nearly as well. Both stuffs are preferred after having been used and washed several times. The way to wash them is to boil them first in a strong lye of potash, and then in a weak one of soap-powder, suffering each boiling to be succeeded by a thorough rinsing in clean water.

"**Wettings.**—Some workmen wet the soles of their

rubbers by dipping into a saucer containing the preparation, and others by holding their bottles upside down, allowing the polish to shower through the drilled punctures of the stopples. Care should be taken not to soak the rubber too much by either means, and after wetting and covering, the sole ought always to be pressed forcibly upon the palm of the hand, so as to equalize the moisture.

"**Rubbings.**—Invariably on beginning with a newly wetted rubbing, gently and regularly sweep the surface from end to end in the running direction of the fibre three successive times; then rub across the grain with a semicircular motion till the polishing tool becomes dry. This operation is, of course, repeated until the whole surface of the pores is no longer visible; the work so treated is now to be left in a clean apartment for a period of twelve hours, this being the time required for the complete absorption of the first body. The sinking period having expired, the work is smoothed, dusted, &c., and then the polishing of it is recommenced. The first sweepings are similar to those described in the preceding embodying, after which ply the rubber wholly with a rotary movement, bearing lightly on it at first, and then slightly increasing the necessary pressure towards the drying of it, which is finally accomplished by sweeping once or twice along the grain expressly to remove any marks that may have been caused by the cross or round rubbings. In these manipulations it is much better to use freely extended motions than contracted ones; therefore the mechanical movements of the arm must on no account be confined. Wipe all the dust off your work at each re-commencement; allow every embodying a proper time to absorb and harden, previous to the re-application of smoothing stuffs or polishes. Cover your rubber with a clean part of the rag at each wetting; carefully guard against working your implement too long in one direction and bearing too heavily on it when it is very wet, else you will be apt to produce coarse marks and streaky roughness. Rubber marks may be removed by being reversely rubbed with a heavily pressed half dry rubber. In polishing a very large surface, such as the top of a dining-table, do only one half at a time.

"In spiriting, the finishing spirit should not be used in excess, because it dissolves a portion of the resinous or gummy body, and thereby causes dimness instead of brightness. If, however, the spirit be slightly mixed with polish, and be sparingly and judiciously employed, the desired clearness of lustre will make itself apparent. Prior to the application of the spirit cloth, which consists of a few loose rags loosely rolled up in the shape of a large finger rubber, and slightly damped with spirit, it is most essential to ply the rubber more quickly and a little longer than ordinary for the purpose of removing all signs of moisture and greasiness from the surface of the gloss. Most polishers seem to think that nothing can be more productive of transparent brilliancy and durable hardness at the finish than the moderate use of spirit that has been somewhat weakened by exposure to the air, and an allowance of two hours as a resting period between the final embodying and the spiriting."

Directions for Re-polishing.

In order to apply this process with facility you will find it needful to disunite the various parts of each article. If your job be a wardrobe, take off the doors by unfastening their hinges, remove all the screw nails, take off the cornice, lift the wings or carcases from the base, and then separate the mouldings and other carved ornaments from the frames and panels of the doors. If it be a chest of drawers, pull the drawers out, unscrew the knobs or handles, remove the scutcheons from the key-holes, free the columns or pilasters from their recesses, and lift the carcase from off the base. If your job should happen to be a sideboard, separate the upper back from the top, unscrew the under back, and then take the base, top, and pedestals asunder. After having disjoined the different portions and ornaments, take a pencil and put tallying marks on every two meeting sides; this will guide you in having everything appropriately replaced when the complete article is finished. The viscid rust must be thoroughly removed from the surface of the

work; this is done by scrubbing it with a paste made of the finest emery flour and spirits of turpentine; after cleansing, and before re-polishing, it is a good plan to merely moisten the face of the work with raw linseed oil, for this causes the old body to unite with the new one. Where shallow dents, scratches, and broken parts of the polish present themselves, carefully coat them two or three times with a thick solution of shellac, and when the last coating becomes hard rub them with soft putty until they become uniformly smooth and even, then proceed to polish its general surface.

Processes for Polishing Furniture.

If the work is full of pores you should give it a coat of clear size before commencing with the polish, and, when dry, go gently over it with very fine glass-paper. The size, by filling up the pores, will prevent both the waste of polish, which would otherwise be absorbed into the wood, and save considerable time over the work. You should place your work in such a situation that the light may shine on it obliquely, so that by looking sideways you may be able to see how the polishing proceeds. Make a wad with a piece of coarse flannel or drugget, by rolling it round and round, over which, on the side you mean to polish with, put a very fine linen rag doubled several times, to render it as soft as possible. Put the wad or cushion to the mouth of the bottle containing the polish and shake it, which will damp the rag sufficiently. Then proceed to rub your work in a circular direction, observing not to do more than a foot square at a time; rub it lightly till the whole surface is covered, and repeat this operation three or four times, according to the nature of the wood. Be very careful in having your rags clean and soft, as the effect of the polish depends in a great measure on its being kept clean and free from dirt. Rub each coat until the rag appears dry, and be careful not to put too much upon the rag at once, and you will obtain a beautiful and lasting polish.

To Polish delicate Cabinet and Papier-maché Work.

No. 1.—Prepare this mixture :—38 ozs. linseed oil, 8 ozs. spirits of wine, 8 ozs. vinegar, 2 ozs. butter of antimony, 8 ozs. oil of turpentine. Shake the mixture well before using, and apply with a woollen rubber.

No. 2.—Instead of the above the following can be used : —16 ozs. oil of turpentine, 16 ozs. rectified oil of amber, 16 ozs. olive oil, 1 oz. oil of lavender, ½ oz. tincture of alkanet. Mix; apply with a cotton rubber well saturated, and then well rub with soft dry cotton rags and wipe dry.

No. 3. *Ingredients.*—3 or 4 pieces of sandarac each the size of a walnut, 1 pint boiled oil, 1 drachm Venice turpentine, a little turpentine if needed to thin with.

Preparation.—Boil the sandarac and oil for 1 hour; when cooling add the Venice turpentine, and if too thick add a little oil of turpentine.

Method of Application.—Apply the mixture all over the furniture, and after some hours rub it off; rub the furniture daily without applying fresh varnish, except about once in two months. Water does not injure this polish, and any stain or scratch may be again covered, which cannot be done with French polish.

No. 4. *Ingredients.*—4 parts of paraffine, 1 part of tallow, 12 parts oil of turpentine.

Preparation.—Melt the paraffine and tallow together, and pour the mixture into a vessel containing hot water; then add the turpentine, stir well, and allow to stand until cool.

To Polish Woods in the Lathe.

Soft woods may be turned so smooth as to require no other polishing than that produced by holding it against a few fine turnings or shavings of the same wood while revolving. Mahogany, walnut, and some other woods may be polished by the use of the following mixture :—Dissolve by heat as much beeswax in spirit of turpentine that the

mixture when cold shall be of about the thickness of honey. This may be applied to furniture or work running in the lathe by means of a piece of clean cloth, and as much as possible should be rubbed off by using a clean flannel or other cloth. Hard woods may be readily turned very smooth; fine glass-paper will suffice to give them a very perfect surface; a little linseed oil may then be rubbed on, and a portion of the turnings of the wood to be polished may be held against the article while it turns rapidly round, which will in general give it a fine gloss.

To Renovate Old Furniture.

Clean it by washing in warm oil, and then bring up the polish by means of a cloth damped with paraffine oil.

A Durable Polish for Ebony

is obtained thus:—Give the work two coats of fine copal varnish and rub them down; when quite dry, smooth with fine pumice. Put on a third coat of the same, and rub down with rotten-stone; clean and put on a flowing coat of best spirit copal varnish, and when this has become quite dry polish with chamois skin and the palm of the hand.

To Polish Walnut.

To give black walnut a fine polish so as to resemble rich old wood, apply a coat of shellac varnish, and then rub it with a piece of smooth pumice-stone until dry. Another coat may be given, and the rubbing repeated. After this, a coat of polish, made of linseed oil, beeswax, and turpentine, may be well rubbed in with a dauber, made of a piece of sponge tightly wrapped in a piece of fine flannel several times folded and moistened with the polish. If the work is not fine enough it may be smoothed with the finest sand-paper, and the rubbing repeated. In the course of time the walnut becomes very dark and rich in colour, and in every way is superior to that which has been varnished.

Waterproof Finish for Veneering.

Ingredients.—Linseed oil 24 ozs., amber 16 ozs., litharge 5 ozs., white lead pulverised 5 ozs., minium 5 ozs., 1 clove of garlic.

Preparation.—Boil the oil in an untinned copper vessel and suspend in it the litharge and minium in a small bag, which must not touch the bottom of the vessel. Continue the boiling until the oil has acquired a deep brown colour; then take out the bag and put in the garlic; repeat this seven or eight times, the boiling being always continued. Before adding the amber with the oil, mix it with 2 ozs. linseed oil, and melt it over a brisk fire. When the mass is fluid it is to be boiled and stirred continuously for two or three minutes; afterwards filter the mixture, and preserve it in bottles tightly corked. When this varnish is used the wood must be previously well polished and covered with a thin coat of soot and spirit of turpentine. When the coat is dry some of the varnish may be applied, which should be equally distributed on every part with a small fine sponge. This operation must be repeated four times, being always careful that each coat is well dried first. After the last coat of varnish the wood must be dried in an oven, and afterwards polished, using the above mixture in the same way as French polish.

Wood Finish.

Richness of effect may be gained in decorative woodwork by using woods of different tone, such as amaranth and amboyna, by inlaying and veneering. The Hungarian ash and French walnut afford excellent veneers, especially the burls or gnarls. The following few useful notes on the subject are given by an American authority. In varnishing, the varnishes used can be toned down to match the wood or be made to darken it by the addition of colouring matters. The polluted compositions known as wood fillers are made up in different colours for the purpose of preparing the surface of wood previous to the varnishing. They fill up the pores of the wood, rendering the surface hard and smooth. For polishing mahogany, walnut, &c., the following is recom-

mended :—Dissolve beeswax by heat in spirits of turpentine until the mixture becomes viscid, then apply by a clean cloth and rub thoroughly with a flannel or cloth. A common mode of polishing mahogany is by rubbing it first with linseed oil and then by a cloth dipped in very fine brick-dust. A good gloss may also be produced by rubbing with linseed oil and then holding trimmings or shavings of the same material against the work in the lathe. Glass-paper, followed by rubbing, also gives a good lustre.

Wax Polishing of Floors.

There is no particular art in wax polishing floors, the principal requirements being plenty of elbow grease and a good hard brush. The floor, after being well scrubbed, is allowed to dry; when dry, it is painted over with a large soft whitewash brush dipped in oak stain : this is allowed to dry for twenty-four hours. The floor is then gone over with thin size, and this is in turn allowed to dry for twenty-four hours. After this the floor is painted over with a kind of varnish made by dissolving beeswax in spirits of turpentine, the proportions being about 1 lb. of wax to 2 quarts of turps. The wax is shredded, placed along with the turps in a stone bottle, and the whole put on the hob and frequently shaken. When this varnish has soaked in, the whole floor is polished with a rather hard brush until a good surface is obtained. Special brushes adapted to polishing wax floors are obtainable at the paint shops.

For large surfaces it is advisable to get the wax more deeply imbedded in the wood, and when a layer has been rubbed on, a hot iron passed over the surface will melt the wax and drive it in. This gives more body to polish on than by the method first described. The work is afterwards treated with more wax on a rubber and finally polished.

Polishing Deal.

No. 1. *Ingredients for Stain.*—As much yellow ochre as can be held in the palm of the hand, and half a teaspoonful of Venetian red, glue size.

Preparation.—Mix the pigments to the consistency of thin paint with the glue size, and let the mixture simmer for some time, keeping it well stirred.

Method of Application.—Apply with a brush, and when dry run over it with fine sand-paper and polish with French polish or, if preferred, turpentine and beeswax. For a deeper colour, add more Venetian red.

No. 2.—Give the wood a coat with a brush of a mixture of 8 ozs. Russian glue melted in 1 quart of water coloured with Venetian red.

To Polish Ebony.

No. 1.—Give the work two coats of fine copal varnish and rub this down (when dry) quite smooth with fine pumice-stone; put on a third coat of the same and rub down with rotten-stone, clean, and put on a flowing coat of best spirit copal varnish, and when this has become quite dry, polish with chamois skin and the palm of the hand.

No. 2.—Add ¼ oz. of best deep black to ½ gill French polish; a little of the deep black may be used on the inside rubbing, but covered twice with linen rag.

To put an Eggshell Polish on Wood.

Three parts of shellac, 1 part gum mastic, and 1 part sandarac gum dissolved together in 40 parts alcohol form a beautiful polish; apply with brush or rag.

Polishing Black Woodwork.

No. 1. *Ingredients.* — 2½ ozs. 90 per cent. alcohol, 1 drachm oil of almonds, 1 drachm gum elemi, ½ oz. orange shellac pounded fine and put into a bottle to dissolve; when dissolved, rub on with white wadding.

No. 2. *Ingredients.*—2 ozs. orange shellac, ½ pint naphtha, 2 drachms benzoin.

Preparation.—Mix and put in warm place for a week and keep the materials from settling by shaking up.

Method of Application.—After having prepared your wood by rubbing some raw linseed oil into it and then wiping it well off again, make a rubber of cotton wool and put some old calico over the pad, and, till you have a good body on your wood, keep the rubber well saturated with polish; then let it stand aside again and finish off with spirits of naphtha if you can; if not, add a small quantity of polish to your spirit.

Polishing Black and Gold Work.

All work to be polished and gilt must be stained with black stain; when quite dry give a very weak solution of glue size; sand-paper smooth. Care must be used not to remove the black stain with the paper. The part to be gilt must not be touched with the size, or the gold will not adhere so well. Polish the part not to be gilt according to the directions given for French polishing, using the black polish deep black. When the work is polished ready for spiriting off, lay the work on a table in a warm room; procure a portion of the best oil gold size, pour in a cup, with a very fine stiff brush lay a thin even coat of gold size on the work; let the gold size dry for ten hours till it becomes lacky, then, having the gold leaf ready, with great care lay a leaf (or part of a leaf, as required) on the cushion, cut to size required; with the tip lay a gold leaf on the sized work, then with a pad made of white wadding press the gold leaf in the crevices, blow off superfluous leaf, let it stand aside to dry; when quite dry, polish gently with a very smooth bone, pointed (or a dog's tooth is best), fixed in a handle. Surplus parts of the edges should be cleaned off evenly afterwards. Finish the black work off with spirits. Very fine crevices may have gold leaf rubbed in with a brush, if used carefully; then blow off surplus parts. For common work gold paint laid on with a brush answers very well.

Polishing White and Gold Work.

No. 1.—Brackets, console-tables, whatnots, chairs, and other furniture are frequently done in white and gold; the grain of the wood should first be filled in with whiting and

glue-size, one or two coats well papered off and white polished, but the wood should not be finished off with spirits until gilt, leaving the last coat to be done when the gilding is finished. The gilding is done as for black and gold.

No. 2.—A cheaper mode and much easier for the amateur is the following:—First well clean the article (if not new) with soda and water; when dry, scrape and smooth all over, stop up cracks with white lead and driers—one of driers to two of white lead; mix some good white paint, made of turps, driers, and white lead, not oil. Give the articles three coats, rubbing down the first coat when dry with pumice and water; when the third coat of paint is quite dry, proceed to gild as before described, using either gold leaf or gold paint; when so done, give the gold a coat of transparent enamel varnish, after which, varnish the white work with clear copal varnish. Give the work two coats; it will set in a day. Small boxes and other fancy articles may be done by this process.

No. 3. *Ingredients and Preparation.*—1 pint linseed oil, 1 oz. alkanet root, ¼ oz. rose pink. Boil for a quarter of an hour, strain through muslin so that the oil may be clear; to use it, pour a little oil on flannel; rub briskly; after two or three applications the effect will be apparent.

No. 4. *Ingredients and Preparation.*—1 pint best vinegar, 1 pint linseed oil, 2 ozs. gum-arabic, finely powdered. Mix in a clean bottle for use. This preparation requires no rubbing, merely laying on with a clean rubber of flannel.

No. 5. *Ingredients.*—4 ozs. beeswax, ½ pint turps, ½ oz. alkanet root, ½ pint linseed oil.

Preparation.—Melt the wax in an earthenware pot, gradually add the turps in which the alkanet root has been steeped, also add the oil, and well mix and keep in wide-mouth bottles for use. Keep the bottles well corked.

Method of Application.—Wipe the dust from the furniture, apply a portion of the polish on a clean rubber of flannel, rub every part accessible, briskly finish off with an old silk handkerchief. This polish is only to be used as a renovator for restoring the gloss on old polished furniture, not for polishing new articles.

No. 6. *Ingredients.*—½ pint rectified wood naphtha, 1½ oz. shellac, ¼ oz. benzoin.

Preparation.—Crush the gum, and put all the ingredients into a bottle; when dissolved it is ready for use. Keep on a shelf in a warm room until dissolved.

No. 7. *Ingredients and Preparation.*—2 drachms shellac and 2 drachms gum benzoin into ½ pint best rectified 90 per cent. alcohol in a bottle closely corked; keep the bottle in a warm place and shake frequently until the gums are dissolved. When cold, add 2 teaspoonfuls of clean poppy oil, well shake it, and it is fit for use. This finish can be carefully laid with a soft rubber or hair brush.

Dry Shining.

This is a new process of polishing or shining, called the American system, and is used mostly for American black walnut. First oil; fill in then with a wet rubber passed smoothly over the work straight from end to end until a shine or gloss appears; no oil to be used on the rubber, and no spiriting off is required. Be careful to dry, rub well, and have the work free from rubber marks.

A Good Polish for Walking Canes and other Hard Wood.

The following process gives the most satisfactory and hardest finished surface:—Fill with best clear filler or with shellac, dry by heating, rub down with pumice; then put on three coats of clear spirit copal varnish, hardening each in an oven at a temperature as hot as the wood and gum will safely stand. For extra work, the first two coats may be rubbed down and the last allowed a flowing coat. For coloured grounds, alcoholic shellac varnish, with any suitable pigment (very finely ground in), can generally be used to advantage.

Water Polish.

Ingredients.—9⅝ ozs. whiting, 16 ozs. alcohol, 1⅜ oz. ammonia. Shake well together.

CHAPTER VIII.

FORMULÆ FOR POLISHING VARIOUS METALS.

To Polish Brass.

Rub the metal with rotten-stone and sweet oil, then rub off with a piece of cotton flannel and polish with soft leather. To remove the tarnish off brass, use a solution of oxalic acid. Wash the acid off with water, and rub the brass with whiting and soft leather. A mixture of hydrochloric acid and alum dissolved in water imparts a golden colour to brass articles that are steeped in it for a few seconds.

Polishing Paste for Brass.

No. 1. *Ingredients.*—3 parts oxalic acid, 40 parts hot water, 100 parts powdered pumice-stone, 2 parts oil of turpentine, 12 parts of soft soap, 12 parts of a fat oil.

Preparation.—Dissolve the oxalic acid in the water and then add the other ingredients.

Polishing Paste for Brass and Copper.

No. 2. *Ingredients and Preparation.*—3 ozs. rotten-stone, 1 oz. powdered soap. Mix and use with a little water.

No. 3. *Ingredients.*—7 ozs. rotten-stone, 1 oz. oxalic acid powdered. Mix and apply damped with a little water.

No. 4. *Ingredients.*—2 ozs. soft soap, 4 ozs. rotten-stone; beat into a paste.

No. 5. *Ingredients.*—Rotten-stone made into a paste with sweet oil.

Polish for Brass.

No. 6. *Ingredients.*—4 ozs. rotten-stone, 1 oz. oxalic acid finely powdered, 1¼ oz. sweet oil, turpentine q.s. to make a paste.

All the above preparations are to clean brass work when it is neither varnished nor lacquered. The first and last are best applied with a little water; the second with a little spirit of turpentine or sweet oil. Both require friction with soft leather.

To polish German silver, copper and brass, use Vienna lime with oil.

Formulæ for Polishes for Brass.

No. 1. *Ingredients.*—Sulphur, chalk and vinegar.

Preparation.—Make a paste with the sulphur, chalk and vinegar, using sufficient of the latter to make the paste of the proper consistency.

Method of Preparation.—Apply the paste to the metal while moist, allow it to dry on, and rub with a chamois skin. For ornaments or engraved work, clean with a brush.

No. 2.—Another process, and one that gives to the brass a very brilliant colour, is to make a wash of alum boiled in strong lye in the proportion of 1 oz. alum to 1 part lye. Wash the brass with this mixture, and afterwards rub with chamois and tripoli.

No. 3.—A weak solution of ammonia in water makes an excellent wash. Apply it with a rag; dry with a piece of shammy, and a very small quantity of jeweller's rouge.

No. 4. *Ingredients.*—2 ozs. sulphuric acid, 1 oz. tripoli, 1 oz. jeweller's rouge, 1 quart cold water.

Preparation.—Put the acid in an earthenware jar, and add the water (the acid should be poured into the water, and the whole stirred with a glass rod). When the heat that is generated has passed off, then add the rouge and tripoli; when well mixed put in a bottle for use.

No. 5.—Small articles to be polished should be shaken by themselves for a short time; then some greasy parings of leather should be put in the barrel with them. After they have been shaken smooth, the greasy leather parings are replaced by clean ones, and the shaking is continued as long as necessary.

No. 6.—When the brass is made smooth by turning, or filing with a very fine file, it may be rubbed with a smooth fine pumice-stone, or with charcoal and water. When it is made quite smooth and free from scratches, it may be polished with rotten-stone and oil, alcohol, or spirits of turpentine.

No. 7.—Brass work can be polished by rubbing the metal with finely-powdered tripoli mixed with sweet oil, and applied with a rubber made from a piece of an old hat or felt; or else a mixture of glycerine, stearine, naphthaline, or creosote, mixed with dilute sulphuric acid, can be used.

Magic Polish for Brass.

No. 8. *Ingredients.*—20 parts sulphuric acid, 10 parts bichromate of potash pulverised, an equal weight of water.

Preparation and Use.—Put the potash-salt in the acid and dilute with the water, and apply well to the brass; wash well in water immediately, wipe dry, and polish with rotten-stone.

Polishing Cloth for Metals.

Ingredients.—4 ozs. soap, 2 ozs. pumice-stone or emery finely powdered, 20 ozs. water. Infusorial earth may be used with advantage. Saturate the best unbleached muslin with this paste. Colour with a little aniline red if desired.

To make Putty Powder.

Put tin, as pure as possible, into a glass vessel—a wine-glass does very well for making small quantities—and pour in sufficient nitric acid to cover it. Great heat is evolved, and care must be taken not to inhale the fumes, as they are

poisonous; when there is nothing left but a white powder, it is heated in a Hessian crucible to drive off the nitric acid.

To Polish Gas Fixtures.

Pickle, and while in the lathe dip the burnisher in the following liquid :—60 parts turmeric root, 60 parts orange shellac dissolved in 20 parts of tartar, 3 parts of ox gall, 6 parts alcohol, 180 parts of water. Dry with a soft cloth.

To Polish German Silver.

Ingredients.—16 ozs. peroxide of iron pure, worked up into a paste with oil. Before using the oxide of iron it should be washed to free it from grit; then put the red oxide of iron into a basin, and pour on it clean water; stir up, and then slowly pour off the crocus and water into a second basin; reject the last portion, which will be very gritty. Let the solid contents of the second basin settle; then stir up with fresh water and pour off, rejecting the last portion. Repeat these processes as many times as required to bring the iron oxide free from grit. Finally, let the oxide settle down; pour off the water, and then collect the oxide in a filter or clean blotting-paper and place it in a clean plate, and dry in an oven out of the way of dust. Pound up the dry oxide in a mortar or by rubbing between the fingers, and then mix with oil.

To use the paste, if the silver is very dirty, rub the paste on with the fingers, and then it will be known if any grit is on the work. If the metal is not very black, take a piece of soft chamois leather and rub some dry crocus on, and, when well rubbed, shake out the leather and let the powder fall off that is not used, or rub it off with a brush. Do not put the leather down in the dust.

To Polish Iron and Steel.

No. 1.—Usually the article to be polished is first rubbed down with emery of gradually increasing fineness; after which the article is moistened with alcohol or water, and

polished with Vienna lime, rouge, or tin putty, *i.e.* putty powder.

No. 2.—Use tin putty and hartshorn triturated in alcohol. Use with soft leather. This gives an excellent polish.

No. 3.—The polish on flat steel pieces in fine watch-work is produced with oilstone dust, burnt Turkey stone and a steel polisher, soft steel, bell-metal, and grain tin.

To Polish Wrought Iron.

Warm the articles till they are unbearable to the hand; then rub them with clean white wax. Heat the goods again, so that the wax may spread over them; then rub them over with a piece of serge.

To give Iron Articles a Brilliant Lustre.

Ingredients.—7½ drachms pulverised arsenious acid, 7½ ozs. elutriated bloodstone, 3¾ ozs. antimony trichloride (butter of antimony), 5 pints 90 per cent. alcohol.

Preparation and Use.—Pour the alcohol over the other articles, and digest at a gentle heat, frequently shaking. When iron is polished with this fluid, it precipitates upon it a thin film of antimony and arsenic, which protects the iron from oxidation, and also gives it a fine appearance.

To make Iron take a Bright Polish like Steel.

Ingredients.—1½ oz. blue vitriol (sulphate of copper,) 1½ oz. borax, 1½ oz. prussiate of potash (ferrocyanide of potassium), 1½ oz. charcoal, ¾ part sifted common salt (chloride of sodium), 6 gills water; heat. Add six quarts of linseed oil; mix well. Bring the iron or steel to the proper heat, and then cool it by dipping in this solution.

To Polish Lead.

Use jeweller's rouge on a chamois skin.

To Polish Old Brasswork which has been Scratched and Tarnished by Wear.

Pumice or bath-brick should be used with, and water for, scouring-off work, and rotten-stone with kerosene oil for the wet finish, and dry for the final polish. The same method should be used for new brasswork. New work should require, after leaving the lathe and vice tools, but little polishing or grinding, and every good workman should try to avoid using the emery stick or emery cloth, as with proper care in the use of tools a great deal of grinding and polishing can be dispensed with. The polishing of metals varies somewhat according to their character, but the main principle underlying all is the substitution of progressively fewer scratches for those left by the material last used, until they become so delicate as to be invisible without the aid of a microscope.

To Clean and Polish Nickel-Plated Goods.

No. 1. *Ingredients.*—Equal parts of precipitated carbonate of iron and prepared chalk, or 2 ozs. prepared chalk and ½ oz. quicksilver. When used, add a small quantity of alcohol, and rub with chamois leather; nickel-platers use ordinary rouge for polishing.

No. 2.—Rouge with a little fresh lard or lard oil, on a wash-leather or buckskin. Rub the bright parts, using as little of the rouge and oil as possible. Repeat the wiping every day, and polishing as often as necessary.

Paste for polishing nickel:—Use chalk mixed with tallow.

To Polish Steel.

Wet Vienna lime to a paste; apply to buff and finish dry.

To Polish Tin.

Vienna lime applied with a linen rag, or whiting and water with a chamois skin, or burnish with wet ox-gall

diluted with water, and wash with water containing a trace of tartar, and dry.

To Polish Finished Surfaces.

Oil is usually employed for polishing delicate instruments, which tends to soil those using them. Oil may be advantageously replaced by a mixture of 3 parts glycerine and 1 of alcohol for large surfaces. When small ones are to be treated pure glycerine can be used.

To Polish Zinc.

Scrape it, and polish with Vienna lime.

CHAPTER IX.

POLISHING MISCELLANEOUS MATERIALS.

To Polish Alabaster.

First use pumice-stone, then apply a paste made by whiting, soap and water, and lastly rub with Canton flannel.

To Polish Book Edges.

A dog's or wolf's tooth is used for this purpose, or a steel burnisher, thus: place the books in a screw-press with boards on each side of them, and other boards distributed between each volume; first rub the edges well with the tooth to give them lustre after sprinkling or staining, and when the edges are dry burnish the front; then turning the press, burnish the edges at the top and bottom of the volume. Burnish the gilt edges in the same manner, after having applied the gold, but observe, in gilding, to lay the gold first upon the front, and allow it to dry, and on no account to commence burnishing till it is quite dry.

To Polish Celluloid.

Make a kind of putty of hot soap free from resin in which equal parts of fine pumice-stone and flour emery have been mixed.

Friction Polish.

A good polish for iron or steel rotating in the lathe is made by using fine emery and oil, which is applied by lead

or wood clamps screwed together. Three very good oils for lubrication are, olive oil, sperm and neat's foot.

To Polish Bone and Horn.

No. 1. *Ingredients.*—Finely-ground pumice-stone and water; apply with felt polishing wheel; finish with rotten-stone applied in the same way.

No. 2.—Scrape the work perfectly level and smooth, then rub it with very fine sand-paper, repeat the rubbing with a bit of felt dipped in finely powdered charcoal with water, and with rotten-stone or putty powder, and finish with a piece of soft wash-leather damped with a little sweet oil; or still better, rub it with subnitrate of bismuth by the palm of the hand.

No. 3.—First scrape the articles with glass to take off any roughness, then grind some pumice-stone to powder, and with a piece of cloth wetted and dipped in the powder, rub them until a smooth surface is obtained. Next polish with rotten-stone and linseed oil, and finish with dry flour and a piece of clean linen rag; the more rubbing with the stone and oil, the better the polish. In the Sheffield factories French sand is used. It is a very fine and cheap sand, and is prepared for use by calcining and sifting.

To Polish Ivory.

Use a mixture of pumice-stone and putty powder.

To Polish Marble.

No. 1.—" If the piece to be polished is a plane surface, it is first rubbed by means of another piece of marble or hard stone, with the intervention of water and two sorts of sand: first with the finest river or drift sand, and then with common house or white sand, which latter leaves the surface sufficiently smooth for the process of gritting. Three sorts of grit stone are employed: first Newcastle grit, second a fine grit brought from the neighbourhood of Leeds, and lastly a still finer, called snake grit, procured at Ayr in

Scotland. These are rubbed successively on the surface with water alone; by these means the surface is gradually reduced to closeness of texture, fitting it for the process of glazing, which is performed by means of a wooden block having a thick piece of woollen stuff wound tightly round it; the interstices of the fibres of this are filled with prepared putty powder (peroxide of tin), and moistened with water. This being laid on the marble and loaded, it is drawn up and down with the same materials, but with rubbers varied in shape according to that of the moulding. The block is not used in this case; in its stead a piece of linen cloth is folded to make a handful; this also contains the putty powder and water. Sand rubbers employed to polish a slab of large dimensions should never exceed two-thirds of its length, nor one-third of its width; but if the piece of marble is small, it may be sanded itself with larger pieces of stone. The grit rubbers are never larger than that they may be easily held in one hand, and the largest block is about 14 in. in length, and 4½ in. in breadth."

No 2.—" Polishing includes five operations. Smoothing the roughness left by the burin is done by rubbing the marble with a piece of moist sandstone; for mouldings either wooden or iron mullers are used, crushed and wet sandstone or sand, more or less fine according to the degree of polish required, being thrown under them. The second process is continued rubbing with pieces of pottery without enamel which have been baked only once, also wet. If a brilliant polish is desired, Gothland stone instead of pottery is used, and potter's clay or fuller's earth is placed beneath the muller. This operation is performed upon granites and porphyry with emery and a leaden muller, the upper part of which is incrusted with the mixture until reduced by friction to clay or an impalpable powder. As the polish depends almost entirely on these two operations, care must be taken that they are performed with a regular and steady movement. When the marble has received the first polish, all flaws, cavities and soft spots are sought out and filled with mastic of a suitable colour. This mastic is usually composed of a mixture of yellow wax, resin and

Burgundy pitch, mixed with a little sulphur and plaster passed through a fine sieve, which gives it the consistency of a thick paste. To colour this paste to a tone analogous to the ground tints, a natural cement of the material, upon which is placed lampblack and rouge, with a little of the prevailing colour of the material, is added. For green or red marbles this mastic is sometimes made of lac mixed with Spanish sealing-wax of the colour of the marble. It is applied hot with the pincers, and these parts are rubbed with the rest. Sometimes crushed fragments of the marble worked are introduced into this cement, but for fine marbles the same colours are employed which are used in painting and which produce the same tones as the ground; the lac is added to give it body and brilliancy. The third operation of polishing consists in rubbing it again with hard pumice, under which water is constantly poured unmixed with sand. For the fourth process, called softening the ground, lead filings are mixed with the emery mud produced by the polishing of mirrors or the working of precious stones, and the marble is rubbed with a compact linen cushion well saturated with this mixture. Rouge is also used for this polish.

"For outside work and for hearths and paving tiles, marble workers confine themselves to this polish. When marbles have holes or grains, a leaden muller is substituted for the linen cushion. In order to give a perfect brilliancy to the polish the gloss is applied. Well wash the prepared surfaces and leave them until perfectly dry, then take a linen cushion, moistened only with water and a little powder of calcined tin of the first quality. After rubbing with this for some time, take another cushion of dry rags, rub with it lightly, brush away any foreign substances which might scratch the marble, and a perfect polish will be obtained. A little alum mixed with the water used penetrates the pores of the marble, and gives it a speedier polish. This polish spots very easily, and is soon tarnished and destroyed by dampness. It is necessary, when purchasing articles of polished marble to subject them to the test of water; if there is too much alum the marble absorbs the water and a whitish spot is left."

To Polish Imitation Marble.

When you have finished marbling, let the work stand for a day or two, then gently rub it down with the back or smooth side of a sheet of sand-paper. This will take off the knits or bits of skin which may be upon it, without scratching it; now give it three coats of the best pale polishing copal varnish, allowing an interval of two days after each coat. Let this stand for three weeks, then cut it down with ground pumice and water, using a piece of wash-leather or rag for that purpose. When you have got it tolerably smooth and level wash it well with clean water, taking particular care to clean off all the pumice ; give it five coats of varnish. It ought now to stand for three to six months before it is polished, for if it is done before, it is almost certain to crack. When the varnish is sufficiently hard cut it down with ground pumice as before, then use rotten-stone and olive oil with the ball of the hand; then flour and oil; finish off with dry flour. This takes a deal of time to do it properly.

Formula for Marble Dressing or Polish.

Ingredients.—10 parts pure beeswax, 2 parts Japan gold size, 88 parts spirit of turpentine.

This mixture is of creamy consistence and should be applied in small quantities with the aid of a piece of white flannel. If it is desired for use upon white marble white wax may be substituted. The same preparation can be used to advantage on woodwork. The Japan size prevents the stickiness which exists when wax alone is used.

To Polish a Black Marble Clock.

Ingredients.—4 ozs. linseed oil, ½ oz. elemi, 2 ozs. methylated spirit, 5 ozs. turpentine, ½ oz. acetic acid, 3½ ozs. water.

Dissolve the elemi in the methylated spirit, and strain. Mix with the oil and add the aqueous fluid.

To Polish Pearl.

No. 1.—Add olive oil to finely pulverised rotten-stone so as to make a thick paste, then add sulphuric acid in sufficient quantity to make a thin paste; apply this paste and rub with a cork covered with velvet, and as soon as the pearl takes the polish, wash off. This is a fine polish.

No. 2.—Go over it with finely powdered pumice-stone washed to separate the impurities and dirt, with which polish it very smooth, then apply putty powder and water by a rubber, which will produce a fine gloss and good colour.

To Polish Piano Keys.

"The frame would not hold the keys sufficiently level or firm. A better way would be to hand-screw a few at a time on a board, and scrape them in that position. They should be burnished with flour paper, care being taken that they do not get too hot during the process. Unless the keys are very hollow or much discoloured, it would perhaps be better to dispense with the scraper altogether, using a coarser glass-paper in its stead. They should be polished singly, on a board covered with several thicknesses of cloth; these should be placed on a bench, and the ivories vigorously rubbed, lengthwise and face downwards, until a good polish is obtained. Putty powder is the best polishing material, though pumice might first be used to take out any marks left by the paper. A very brilliant polish may be got by finishing the keys with a similar board covered with wash-leather, and sprinkled with rouge. A liberal supply of water is necessary during the process."

To Polish Plaster of Paris Work.

Add to the gypsum 1 or 2 per cent. of alum, sulphate of potash, or borax. The gypsum will set slowly, and is capable of receiving a high polish.

To Polish Quartz, &c.

To get a fine polish on such stones as quartz, granite, &c., grind the surface on a grindstone, the last grinding being very light, and then rub with ground pumice-stone and water on the end of a piece of wood or on a piece of sole leather, finishing with a piece of sole leather with oxide of tin or rouge wet. The same process will answer for polishing geological specimens such as coral, onyx, jasper, &c. A piece of felt or heavy woollen cloth tacked on a board also makes a good polisher. An ordinary lapidary's outfit consists of appliances not usually kept on sale, but which every machine shop can readily furnish. You will need a frame with wheel, shaft, and spindle, with several lead-laps, one for coarse and one for fine emery, and one or more for polishing, also a lap made with end wood on a chuck for polishing, and a leaden polisher, desirable for rounded work. A thin disk of copper, mounted on ordinary lathe spindle, is used for slitting with emery. In using diamond dust, which is employed in working on diamonds and in some other cases, a sheet steel disk, very thin, should be used.

To Polish Shells.

No. 1.—Boil in a strong solution of potash, then polish with hydrochloric acid and putty powder.

No. 2.—Clean the surface with hydrochloric acid until the outer skin is removed. Wash in warm water, dry in sawdust, and polish with chamois skin. If the shell is destitute of natural lustre, rub with tripoli powder and turpentine with a chamois skin, and finally finish with olive oil.

To Prepare and Polish Shells.

No. 1.—Porcelainous shells are so hard as to require the apparatus of a lapidary to cut or polish them, but they are generally so smooth as to require no rough grinding. They may be polished by using a felt wheel and applying

putty powder. Nacreous shells, or those of the pearl variety, may be filed and cut without a great deal of difficulty. Pieces to be turned are first roughly shaped on the grindstone, then turned and polished with pumice-stone, putting on the final polish with rotten-stone. Irregularly shaped pieces are filed and ground, then smoothed with pumice-stone and water, and finished with rotten-stone. The rotten-stone is sometimes mixed with sulphuric acid, full strength or slightly diluted, to heighten the polish.

No. 2.—Rough shells are polished by first grinding them on a coarse stone, then smoothing them with pumice-stone and water on a buffer-wheel or with a hand polisher, and finishing with rotten-stone.

To Polish Show Cases.

A good polishing powder consists of rock alum burned and finely powdered 3 parts, levigated chalk 1 part. Mix; apply with a dry brush.

To Polish Slate.

Slate is faced first with an iron plate with river sand and water, smoothed with pumice-stone, then japanned and baked to harden the japan, and again smoothed with pumice-stone and polished with rotten-stone.

To Polish Vulcanite.

No. 1.—Remove scratches with a smooth wet water of Ayr stone, and then polish in the lathe with fine pumice and a stiff brush. After washing the pumice off, polish it with whiting and a soft brush.

No. 2.—The mathematical instrument makers treat it as brass, that is, for flat work they first use water of Ayr stone, and then rotten-stone and oil. Turned work is polished in the lathe with rotten-stone and oil, taking care as to too high a speed, which would heat the work. Some use lampblack and oil to finish with, where a very high polish is wanted, or the

bare palm of the hand, as in getting up silver plate. Chain and ornament makers use circular buffs for their flat work made of sea-horse leather, and for work of irregular forms buffs of calico.

To Clean and Polish Silverware.

Use any of the powders given below, or the liquid polishes also given. It should be remembered that every polish removes a portion of silver, so that cleaning should be resorted to only when absolutely necessary.

No. 1.—5 parts of caustic ammonia, 200 parts of water, 20 parts sodium hyposulphite, 10 parts of ammonic chloride.

No. 2.—Have ready a basin containing equal parts of oil of vitriol and water. Make the article white in a gas flame, not white heat, but a snowy white, which it will assume after exposure to the flame, then plunge it into the pickle, and there leave it for one half-hour, then dry in box dust. This formula applies to solid ware only.

No. 3.—Heat to a dull red (if there is no lead present), allow to cool, and when cold boil in a pickle of water acidulated with sulphuric acid (30 water, 1 acid) until perfectly white; take out, swill in clean water, and burnish the prominent parts; dry in hot boxwood sawdust.

No. 4.—Commence by cleaning off any kind of dirt which the surface of the silver articles had contracted while making, as that would entirely spoil the burnishing. For this purpose take pumice-powder, and with a brush made very wet in strong soapsuds, rub the various parts of the work, even those parts which are to remain dull, which nevertheless receive then a beautiful white appearance; wipe with an old linen cloth, and proceed to the burnishing.

No. 5.—A few drops of nitrobenzol are added to 40 parts of vaseline (common), 50 parts of whiting are now stirred in, together with 10 ozs. burnt hartshorn, and 10 parts of very finely powdered cuttle-bone; mix thoroughly.

No. 6.—15 parts of the finest whiting, 1½ part of soda, ⅜ part of citric acid. Reduce to fine powder. Use by moistening the powder with water.

No. 7.—Use a burnisher, wet with soap water. Vienna lime will also polish silver.

No. 8.—Silver polishing (Putz) pomade.

Ingredients.—4½ parts vaseline, a few drops of essence of mirbane (nitrobenzol), 7½ parts elutriated chalk, 1½ part burnt hartshorn, 1½ part pulverised cuttle-bone (*Ossa sepia*).

Preparation.—Mix the vaseline and mirbane essence thoroughly, then add the other ingredients, and manipulate until the mixture has the consistence of butter.

No. 9. *Ingredients.*—8 ozs. fine chalk, 3 ozs. pipeclay, 2 ozs. white lead, ¾ oz. magnesia carbonate, ¾ oz. jeweller's rouge.

Compound for Waxing and Polishing Floors.

Ingredients.—200 parts linseed oil, 20 parts litharge, 150 parts wax, 18 parts of tallow, 190 parts molasses, 103 parts lampblack, 210 parts oil of turpentine, 35 parts alcohol, 5 parts shellac, 2 parts aniline violet.

Preparation.—Boil the linseed oil with the litharge for 1 hour, then melt the wax and tallow in the hot fluid, add the molasses, and keep the whole at a temperature of 230° to 248° F., until all the water is volatilised; then add the lampblack or any other colouring matter, and, after cooling, the oil of turpentine, and finally the shellac dissolved in alcohol and the aniline violet.

To make a Floor Wax for Polishing Floors.

Ingredients.—5 parts purified potash, 20 parts of water, 25 parts of wax, 400 to 450 parts of hot water.

Preparation.—Boil the potash, wax, and water together, stirring constantly until a thick fluid and homogeneous compound has been formed, and no more watery fluid is

separated, then take the vessel from the fire carefully; add first a few drops of boiling water and then a larger quantity so as to form a fat-like mass, in which no water can be detected, then replace the vessel on the fire, heat the compound without allowing it to come to a boil, and add gradually and with constant stirring the 400 to 450 parts of hot water.

CHAPTER X.

FORMULÆ FOR PREPARING LACQUERS FOR WOOD, METAL, AND OTHER MATERIALS, AND METHODS OF USING SAME.

The term lacquer is usually restricted to spirit varnishes and those compositions in which lac is the chief ingredient. These preparations are usually used for metal, leather, &c., while varnishes are used for wood, composition ornaments, &c. As the recipes are fully indexed, no attempt at classifying them for particular purposes has been made in the following.

Parisian Bronze Lacquer.

Ingredients.—1 part shellac, 8 to 10 of alcohol, ¼ part of camphor, a few drops of lavender oil.

Preparation.—Dissolve the lac in the spirit, rub up the camphor in the lavender oil and mix the two.

Parisian Bookbinder's Lacquer.

Ingredients.—360 parts shellac, 2 parts camphor, 2 parts loaf sugar, 3000 parts of alcohol of 66 per. cent., a trace of oil of cinnamon.

Preparation.—Dissolve by means of a water bath the lac, camphor, and sugar in the spirit, then filter the solution through blotting-paper, distil off half of the alcohol and add to the residue while yet warm a trace of oil of cinnamon.

French Leather Lacquer.

Ingredients.—15 parts of logwood shavings, 120 parts water, 2 parts of sugar, 12 parts gum-arabic, ferric sulphate solution q.s., alcohol q.s.

Preparation.—Boil the logwood in the water until it is reduced to one half, then dissolve the sugar and gum in this solution, and add the solution of ferric sulphate until the primarily brown-red colour of the decoction has changed into a rich blue tint, then add the spirits of wine.

Lacquer for Drawings.

Ingredients.—3 to 4 parts of gum dammar, 18 parts of acetone, 3 parts of thickly fluid collodion.

Preparation.—Dissolve the gum in the spirit, then mix 4 parts of the solution with 3 parts of collodion.

Cheap Lacquer for Harnesses and Carriage Tops.

Ingredients.—2 parts of glue, 3 parts of ordinary soap, water q.s., 3 to 4 parts of spirit varnish, 2 parts good wheat starch.

Preparation.—Soak the glue in water and then liquefy it over a moderate fire. Also dissolve the soap in water separately, and then mix the two solutions; about 120 parts of water will be necessary for dissolving both ingredients. After the two solutions have been intimately mixed, add the spirit varnish, and finally stir in the starch, which should have been previously stirred into a paste with some water. Now place the pot containing the mixture over a moderate coal fire, and let it evaporate, although it may also be used before evaporation; the evaporated mass when to be used is liquefied by adding beer or water. The thinner the coat the more beautiful will be the gloss.

Transparent Lacquer for Closing Bottles.

Ingredients.—2 parts of resin, 4 of ether, 6 of collodion, and any desired colouring matter.

Preparation.—Dissolve the resin in the ether, and then add the collodion.

Method of Application.—Dip the neck of the bottle into the tenacious mass and quickly withdraw it with a rotary motion. The label or stamp of the firm can be impressed in the mass while plastic.

Elastic Lacquer.

Ingredients.—15 parts of lime, 20 parts of water, 50 parts of melted crude caoutchouc.

Preparation.—Slake the lime in the water, and add the crude caoutchouc while the lime is yet warm. When cold the lacquer is in the form of a paste. It is best applied warm.

Black Harness Lacquer.

Ingredients.—40 parts best shellac, 10 parts laudanum, 5 parts of mastic, 500 parts spirits of wine, 20 to 30 parts pure Venetian turpentine, aniline black (nigrosine) dissolved in water or alcohol.

Preparation.—Dissolve the resins in the spirits, and, to prevent the lacquer becoming brittle, add the solution of Venetian turpentine and sufficient nigrosine to give the mixture an intense black colour.

Ordinary Body Carriage Lacquer.

Ingredients.—2 parts best African copal, 7 parts of clarified linseed oil, 8 parts of turpentine, 2 parts best gum anime, 5 parts clarified linseed oil, and 7 parts of turpentine.

Preparation.—Two kinds of varnish have to be separately made, and when dry are mixed thus. Boil the first three ingredients together for 4 hours, mix thoroughly by stirring, and then strain. Secondly, boil the anime, 5 parts of oil and 7 of turpentine for a similar period; strain while it is hot, and put it into the pot used for preparing the copal varnish. Mix 2 parts of the anime varnish with 1 of the

copal varnish. This mixture will dry quicker and harder than the best boiling copal varnish, and will polish very soon.

Neil's Carriage Lacquers.

1st.—Melt 2 parts of best copal, add gradually 10 parts of clarified linseed oil; boil until viscid, then reduce it with 6 parts oil of turpentine, and filter.

2nd.—Melt 2 parts of gum anime, add 5 parts of clarified linseed oil; boil until viscid, reduce with 7 parts of oil of turpentine, and filter. The two lacquers can be used either by themselves, or, in case a quick-drying lacquer is required, mixed in equal parts.

Amber and Elemi Lacquer.

Ingredients.—4 parts amber, 1 part elemi, 1 part Venice turpentine, 12 parts oil of turpentine. This makes a very beautiful and lasting lacquer.

Chinese Lacquer Work.

Ingredients.—2 parts copal, 1 part shellac, 2 parts boiled linseed oil, 10 parts oil of turpentine. If a yellow or red colour is required, gum guttae (or gamboge) dissolved in oil of turpentine, and dragon's blood dissolved in the same liquid with the colouring matter used.

Preparation.—Melt the copal and shellac together, and when fluid add the boiled oil; and after the vessel containing this mixture has been taken from the fire, gradually add the oil of turpentine, and, if the lacquer is to be coloured, the liquid colouring matter of gamboge or dragon's blood.

Method of Using.—Lay the lacquer on a ground of tinfoil.

Colourless Lacquer.

No. 1. *Ingredients.*—5 parts mastic, 5 parts amber, 10 parts sandarac, 10 parts shellac, 100 parts alcohol.

No. 2.—Dissolve bleached shellac (freshly bleached, or it will not dissolve) in pure alcohol; settle and decant

Make the lacquer very thin. The usual lacquer for brass is made with ordinary shellac and alcohol, made very thin, settled and decanted.

Colour for Lacquer for Brass.

Ingredients.—1 pint alcohol, 2 ozs. annatto. Digest.

Comb Maker's Lacquer.

Ingredients.—Digest 1 part of elemi, 1 part of mastic, and 5 parts of shellac in 20 parts of strong alcohol.

Lacquer for Copper-plates.

Ingredients.—6 parts mastic, 6 parts camphor, 15 parts bleached sandarac, 15 parts bleached shellac, 200 to 280 parts strong alcohol.

Lacquer for Copper.

Ingredients.—8 parts mastic, 6 parts camphor, 15 parts sandarac, 15 parts bleached shellac, 40 parts alcohol.

Green Lacquer.

Ingredients.—18 ozs. turmeric, 15 ozs. shellac, 1 oz. sandarac, 3 ozs. elemi, 3 ozs. gamboge, $4\frac{1}{2}$ gallons methylated spirit.

Preparation.—Digest all the ingredients in two-thirds of the spirit, then strain, and to the sediment add the remainder of the spirit, and strain; then mix the two portions of strained fluid.

High Coloured Lacquer.

Ingredients.—2 quarts spirits of wine, $2\frac{1}{2}$ ozs. shellac, 2 ozs. sandarac, $\frac{1}{2}$ oz. elemi, 1 quart wood alcohol.

Preparation.—Mix, and keep gently warmed for two or three days; strain, colour with dragon's blood to tone

required, and then thin with the second quantity (*i.e.* 1 quart) of alcohol.

Linseed Oil and Caoutchouc Lacquer.

Ingredients.—2 parts of caoutchouc is swelled in 1 part of ether, and rendered fluid by heating, then 1 part linseed oil and 1 part of turpentine are added, both these oils being warmed before adding.

Matt Lacquer (Matolein).

Ingredients.—30 parts of sandarac, 7 parts mastic, 320 parts of ether, 100 to 200 parts of benzine.

Preparation.—Dissolve the two resins in the ether, then add the benzine ; the more of the latter is added the coarser will be the grain.

Lacquer for Sheet Metal.

Ingredients.—5 parts asphaltum, 3 parts colophony, 10 parts oil of turpentine varnish, 14 parts of oil of turpentine.

Pale Lacquer.

Ingredients.—2 quarts of methylated alcohol, 2½ ozs. shellac, 2 ozs. sandarac, ½ oz. elemi, 1 quart wood alcohol.

Preparation.—Mix all but the last portion of spirit, put the mixture into a tin varnish can, and submit it to a gentle heat for a day or two ; then strain off, and add the quart of alcohol to the sediment ; strain, and mix that with the other strained portion.

Green Bronze Lacquer.

Ingredients and Preparation.—1 quart strong vinegar, ½ oz. mineral green, ½ oz. raw amber, 2 ozs. sal ammoniac, ½ oz. gum-arabic, 2 ozs. French berris, ½ oz. copperas. Dissolve the whole in a pipkin over a gentle fire, allow to cool, and then filter.

Lacquer for Philosophical Instruments.

Ingredients.—¾ oz. gum guttae (or gamboge), 2 ozs. gum sandarac, 2 ozs. gum elemi, 1 oz. of dragon's blood, 1 oz. seedlac, 2 grains oriental saffron, 20 ozs. pure alcohol.

Preparation.—Digest the saffron in the alcohol to make a tincture, by infusing it in the spirit for twenty-four hours, or exposing to the sun's heat in summer; strain the tincture through linen, squeezing tightly, then having pounded all the other ingredients, pour the tincture over them, and allow digestion to proceed.

Lacquer for Photographs.

Ingredients and Preparation.—Dissolve 1 oz. of dammar in 6 ozs. of acetone. Apply several times.

Resin Lacquer.

Ingredients.—Mix 1 part asphaltum, 4 parts resin, 2 parts oil of turpentine, 3 parts linseed-oil varnish.

Cheap Lacquer for Leather.

Ingredients.—23 parts black pitch, 69 parts benzole, 8 parts of turpentine. Dissolve the first two, then add the last ingredient.

Black Lacquer for Leather.

Ingredients.—6 parts red shellac, ⅕ part Venice turpentine, ⅕ part castor oil, ⅕ part sandarac, 30 parts strong alcohol, 1 part nigrosine.

Preparation.—Dissolve the nigrosine in a small portion of the alcohol, and in the remainder of it digest the other ingredients, then mix the two fluids.

Lacquer for Terra-cotta.

Ingredients.—1 part shellac, 3 parts raw turpentine, 10 parts shellac, 20 parts alcohol.

Lacquer for Stoves.

Ingredients.—Seed or shellac dissolved in spirits of wine.

Method of Use.—Clean and polish the tools so as to be free from grease, then slightly warm and varnish with the lac varnish; the success of the operation depends on the cleanness of the surface. A finger touch before varnishing will affect the finish.

Turner's Lacquer.

Ingredients.—4 parts elemi, 20 parts bleached shellác, 4 parts Venetian turpentine, 60 parts alcohol. Digest the solids in the spirit.

A Universal Lacquer

which is equally good for paper, metal, wood, glass, &c., and which admits of being coloured with any aniline dye soluble in alcohol, is prepared as follows :—

Ingredients.—60 grains bleached shellac, 60 grains freshly-powdered Manilla copal, 60 grains mastic, 1 grain boracic acid, $2\frac{1}{4}$ lbs. alcohol of 92 to 95 per cent., glass (powdered) q.s.

Preparation.—Mix all the ingredients but the boracic acid with the alcohol, and let it digest from eight to fourteen days, frequently shaking; then add the boracic acid, and filter.

Lacquer for Wall-paper.

Ingredients.—Borax and shellac equal parts, 10 times their weight of alcohol; digest, strain, and give two coats. For a very light-coloured paper use sandarac instead of shellac. Paper treated with this lacquer can be washed with water, and even with soap if necessary.

Spirit Lacquer for Lacquering Wax Tapers.

Ingredients.—4 parts mastic, 40 parts sandarac, 96 parts of alcohol of 96 per cent.

Preparation.—Put the resins in a fine sieve, and suspend the sieve over the alcohol so that the latter just covers them. When the resins are dissolved—in about twenty-four hours—filter.

Wax Lacquer.

Ingredients.—2 parts white wax, 3 parts benzol.

Lacquer for Wood.

Ingredients.—5 parts mastic, 5 parts sandarac, 5 parts elemi, 5 parts seedlac, 5 parts boneblack, 10 parts shellac, 100 parts alcohol. Digest.

Lacquer for Basket and Wicker Work.

"A lacquer which shall answer for this purpose must always possess a certain degree of elasticity, and can be prepared without great difficulty by the following process:—Good linseed oil is boiled in a capacious vessel until one drop of it, when poured upon a cold stone slab, becomes so viscid that it strongly adheres to the finger when touched, and can be drawn out in long threads. The twentieth part of the linseed oil is mixed with good fat copal varnish, and then the lacquer is reduced with as much oil of turpentine as is required to bring it to the desired consistency. To colour this lacquer, if required, it is best to add aniline colours dissolved in benzol, and to mix the solution intimately with the lacquer."

Ebony Lacquer for Woodwork.

Ingredients.—$\frac{1}{3}$ oz. aniline hydrochloride, $\frac{1}{3}$ oz. alcohol, 1 part sulphate of copper, 100 parts of water.

Preparation.—Dissolve the aniline dye in the alcohol, and the copper sulphate in the water.

Method of Application.—Coat the wood with the solution of copper sulphate; let the wood thoroughly dry, and then apply the aniline salt tincture. In a short time the copper salt that has been absorbed by the wood will react on the

aniline hydrochloride, producing a deep black colour. This combination has been called nigrosine, on account of its black colour, and cannot be destroyed either by acids or alkalies. The wood can therefore be left without further coating, but if it is desired to give it a lustre, a coating of ordinary cabinet-maker's varnish will be sufficient for the purpose.

Bookbinder's Lacquer.

No. 1. *Ingredients.*—10 parts shellac, 1 part oil of turpentine, 30 parts spirits of wine. Digest.

No. 2. *Ingredients and Preparation.*—1 part dragon's blood, 10 parts gum size, 2 parts sandarac, 20 parts shellac, 5 parts Venetian turpentine, 100 parts spirits of wine. Digest.

Bookbinder's Ordinary Brown Lacquer.

Ingredients and Preparation.—$4\frac{1}{2}$ ozs. brown shellac, $3\frac{5}{6}$ lbs. of alcohol 84 per cent. Dissolve the shellac; filter; and then distil off, or evaporate, half the alcohol, and add $\frac{1}{4}$ oz. of oil of lavender to the remaining fluids.

Bookbinder's White Lacquer.

Ingredients and Preparation.—$4\frac{1}{5}$ ozs. bleached shellac, 0·6 oz. alcohol 92 per cent. Dissolve, filter, and evaporate to a quarter its bulk by distillation, then add ·14 oz. of oil of lavender.

Paris Brown Bookbinder's Lacquer.

Ingredients and Preparation.—$8\frac{3}{4}$ ozs. shellac, ·525 oz. oil of lavender, 1·05 oz. gamboge, $2\frac{3}{4}$ lbs. of 98 per cent. alcohol.

Prepare this lacquer precisely as the last, and then add 1·4 oz. bookbinder's brown lacquer of the same quality; finally filter from the sediment.

Bookbinder's New Brown Lacquer.

Ingredients.—4$\frac{1}{5}$ ozs. shellac refined, 17$\frac{1}{2}$ ozs. wood spirit (methyl alcohol).

Preparation.—Put the shellac in a glass bottle, pour the spirit over it, and frequently shake the bottle until the shellac is dissolved, then add ·175 oz. oil of lavender, and filter through blotting-paper.

In this manner a reddish brown lacquer of good consistency is obtained, which gives a fine lustre to articles of leather and is very durable.

Bookbinder's New White Lacquer.

Ingredients.—6·3 ozs. bleached shellac, 17$\frac{1}{2}$ ozs. wood spirit, ·175 oz. oil of lavender.

Preparation.—Similar to the last.

English Lac Varnish for Boxes and Fancy Articles.

Ingredients.—11$\frac{1}{5}$ ozs. seedlac, 4$\frac{1}{5}$ ozs. sandarac, 5$\frac{1}{2}$ ozs. elemi resin, 8$\frac{3}{4}$ ozs. powdered glass, 3$\frac{1}{3}$ lbs. of alcohol 90 per cent., 4$\frac{1}{5}$ ozs. hot turpentine.

Preparation.—Powder the resins and the glass, mix them together, then dissolve the resins in the alcohol by means of a water bath. Afterwards add the turpentine at the same temperature as the alcoholic solution; shake well, and filter. The powdered glass is to facilitate the solution of the resins by preventing them cohering.

Lac Varnish for Turners.

Ingredients.—2·1 ozs. shellac, $\frac{1}{10}$ oz. mastic in tears, alcohol q.s.

Preparation.—Powder the shellac and mastic, then pour over the mixed powders sufficient alcohol to stand about 1$\frac{1}{2}$ inch above them; dissolve by a gentle heat, and then boil down to the consistency of syrup.

Method of Application.—The turned articles of wood or

horn are thoroughly pumiced, then given a coat of linseed oil, which is allowed to drain off; then a coat of the above lac varnish is applied.

Lacquer for Floors.

No. 1. *Ingredients and Preparation.*—10 parts colophony, 20 parts ruby shellac, 5 parts Venetian turpentine, 100 parts spirits of wine. Dissolve.

No. 2. *Ingredients.*—15 parts colophony, 10 parts ruby shellac, 5 parts oil of turpentine, 60 parts spirits of wine. Dissolve.

No. 3. *Ingredients.*—5¼ ozs. shellac, 17 gills alcohol.

This lacquer is for use on floors which have been painted any colour, as the thin coating of lacquer will make the colour more durable than would be the case without it.

Bernarth's Formula for ditto.

Ingredients.—17½ ozs. shellac, 8¾ ozs. white colophony, ·07 oz. camphor, 6·6 lbs. alcohol 96 per cent.

Preparation.—Powder the lac, colophony, and camphor; dissolve in the spirit by warmth and frequent shakings, then filter through a cloth. This lacquer should be warmed when it is used. 17½ ozs. cover a floor surface of 36 square feet.

An Excellent Ground Lacquer for Soft-wood Floors

is obtained by adding to the above 5·50 lbs. of powdered and washed ochre to every 1·1 lb. of the lacquer.

Gold Lacquer.

No. 1. *Ingredients and Preparation.*—¾ oz. dragon's blood, 1½ oz. gamboge, 2 ozs. mastic, ½ oz. saffron, 2 ozs. sandarac, 10 ozs. shellac, 50 ozs. alcohol. Dissolve the dragon's blood, gamboge and saffron separately in small quantities of

alcohol, and the resin in the remainder of the spirit; then mix altogether.

No. 2. *Ingredients.*—2½ ozs. turmeric, ½ oz. dragon's blood, 1½ oz. gamboge, 1 oz. elemi, 5 ozs. seedlac, 5 ozs. mastic, 5 ozs. sandarac, 2½ ozs. Venetian turpentine, 5 ozs. alcohol.

Preparation.—Dissolve the first three colouring matters separately in small quantities of alcohol, filter each, and mix, and in the remainder of the spirit dissolve the other bodies, then add the turpentine and solution of colouring matters.

Glossy Lacquer.

Ingredients.—1 oz. amber, 2 ozs. copal, 3 ozs. seedlac, 2½ ozs. mastic, 2½ ozs. sandarac, 5 ozs. shellac, 2 ozs. Venetian turpentine, 50 ozs. alcohol. Dissolve by heat and shaking.

Quick drying Glossy Lac Varnish (Wessner's formula).

Ingredients.—13·125 ozs. refined shellac, 33¼ ozs. alcohol 90 per cent., 7 ozs. Venetian turpentine.

Preparation.—Powder the shellac, dissolve it in the spirit by the aid of the heat of a water or sand bath; then add the turpentine to the solution; shake well and filter.

Resin Lacquer.

No. 1. *Ingredients and Preparation.*—10 ozs. colophony, 1½ oz. elemi, 30 ozs. spirits of wine. Dissolve and filter.

No. 2. *Ingredients.*—12½ ozs. colophony, 2½ ozs. mastic, 2½ ozs. shellac, 75 ozs. spirits of wine.

Red Lacquer for Wood.

Ingredients.—1 oz. elemi, 1 oz. mastic, 4 ozs. sandarac, 2 ozs. shellac, 2 ozs. Venetian turpentine, 25 ozs. alcohol, ½ oz. dragon's blood.

Preparation. — Dissolve the red colouring matter in a little alcohol, separately dissolve the other solids in the remainder of the spirit; then add the turpentine and tincture of dragon's blood; well shake to mix, then filter.

Black Lacquer for Wood.

Ingredients.—1 oz. elemi, 1 oz. seedlac, 1 oz. mastic, 1 oz. sandarac, 2 ozs. shellac, 1 oz. Venetian turpentine, 20 ozs. alcohol, 1 oz. bone black.

Preparation.—Rub up the bone black in the turpentine, and add them to the solution formed by dissolving the resins in the spirit.

Lacquer for Comb Makers.

Ingredients.—1 oz. elemi, 1 oz. mastic, 5 ozs. shellac, 20 ozs. alcohol. Dissolve.

Lacquer for Tinsmiths.

Ingredients.—1 oz. elemi, 5 ozs. seedlac, $2\frac{1}{2}$ ozs. sandarac, $2\frac{1}{2}$ ozs. bleached shellac, 4 ozs. alcohol. Dissolve.

Lacquer for Copper Plates.

Ingredients.—1 oz. camphor, 1 oz. mastic, $2\frac{1}{2}$ ozs. sandarac, $2\frac{1}{2}$ ozs. bleached shellac, 40 ozs. alcohol.

Lacquer for Dark Wall Paper.

Ingredients.—1 oz. borax, 1 oz. stick or shellac, 10 ozs. hot water. Dissolve the borax and shellac in the water, strain through a cloth, and apply the lacquer to the paper either before or after it is put on the wall. When dry, brush the paper over with a soft brush which will give it a fine lustre. Two coats should be given in the usual manner with a brush, the first coat being thoroughly dry before the second is put on.

Lacquer for Light Wall Paper.

Ingredients and Preparation.—Similar to the last, but sandarac being used instead of shellac.

Lacquer for Brass.

Ingredients.—1 oz. shellac, 1 oz. seedlac, ½ oz. Venetian turpentine, 20 ozs. alcohol.

Photographer's Lacquer.

No. 1.—A hard lacquer for photographer's negatives :—
Ingredients.—20 parts sandarac, 2 parts Venetian turpentine, 2½ parts oil of lavender, 2½ parts ether, 50 parts absolute alcohol. Digest the resin in the mixed fluid.

No. 2. *Ingredients.*—1 oz. mastic, 5 ozs. bleached shellac, 2 ozs. oil of turpentine, 30 ozs. alcohol.

No. 3. *Ingredients.*—1 oz. amber, 1 oz. copal, 2 ozs. benzole, 15 ozs. spirits of wine.

No. 4. *Ingredients.*—1 oz. amber, 1 oz. copal, 1 oz. mastic, 5 ozs. petroleum naphtha, 10 ozs. spirits of wine.

In preparing lacquers for photographer's use, only the purest materials should be used, as the lacquer should be entirely colourless.

Elastic Dammar Lacquer.

No. 5. *Ingredients.*—1·4 ozs. dammar, 6·3 ozs. acetone. Dissolve by standing the ingredients in a closed bottle in a moderately warm place for 14 days; and, pouring off the dissolved portion from the residuum, apply with a soft brush and give several coats.

No. 6. *Ingredients.*—1 oz. amber, 1 oz. copal, ½ oz. mastic, 5 ozs. petroleum naphtha, 10 ozs. spirits of wine. Dissolve.

Black Lacquer for Leather.

No. 1. *Ingredients.*—1 part shellac, 5 parts turpentine, 40 parts alcohol, ½ part extract of logwood, $\frac{1}{10}$th part bi-

chromate of potash, ½ to 1 part Indigo carmine if a bluish tinge is required.

Preparation.—Dissolve the logwood extract in the spirits of wine, and then add the potash salt to this mixture; an intensely black colour results from mixing these two bodies, which gives a glossy black colour to the lacquer immediately after it is dry. Dissolve the shellac in the turpentine and mix with the black alcoholic fluid. If a bluish tinge is required the indigo carmine is dissolved in the ready lacquer.

No. 2. *Ingredients.*—15 ozs. ruby shellac, ½ oz. Venetian turpentine, ½ oz. sandarac, ½ oz. castor oil, 75 ozs. alcohol, 2½ ozs. aniline black.

Preparation.—Rub up the black in a little alcohol, dissolve the resin in the remainder of this, add the turpentine and castor oil; the latter body is to give flexibility to the varnish so as to prevent it cracking.

No. 3.—The following lacquer has a greenish colour, but very quickly turns black when it is applied to leather :—

Ingredients.—4·4 ozs. borax, 4·4 ozs. shellac, 22 ozs. water, 4·4 ozs. logwood, 4·4 ozs. water, 2·2 ozs. green vitriol (ferrous sulphate), 3·3 ozs. water.

Preparation.—Boil the borax and shellac in the first quantity of water separately, boil the logwood with second quantity, and thirdly dissolve the salt of iron in the last quantity of water. Mix the logwood extract and iron solution, then mix the solution of shellac with the mixture, and shake well.

Cheap Glossy Lacquer for Leather.

Ingredients.—1 part black pitch, 4 parts benzole. Dissolve by heat; and the lacquer, which dries quickly, is very well adapted for lacquering shoe leather, as it retains a certain elasticity. If it is desired to still further increase the latter property, a few per cents. of turpentine may be added to the solution.

Bronze-Coloured Shoe Lacquer.

Ingredients.—1·1 lb. of shellac, 2·8 lbs. aniline blue or aniline red, 4·4 lbs. water, alcohol q.s.

Preparation.—Dissolve either the blue or red dye in the water according as a greenish or brownish gloss is desired, and dissolve the shellac in the mixture by boiling it.

Lacquer for Harness Makers.

Ingredients.—2½ ozs. colophony, ½ oz. lampblack, 1 oz. mastic, 2½ ozs. sandarac, 10 ozs. shellac, 2½ ozs. Venetian turpentine, 50 ozs. alcohol.

Preparation.—Rub up the black pigment in the turpentine, and mix with the solution of the resins in the alcohol.

Lacquer for Terra-Cotta.

Ingredients.—1 oz. mastic, 10 ozs. shellac, 2½ ozs. Venetian turpentine, 30 ozs. alcohol.

Lacquer for Gilt Articles.

Ingredients.—2 ozs. amber, ½ oz. seedlac, 2 ozs. sandarac, ½ oz. dragon's blood, ½ oz. gamboge, ½ oz. sanders wood, ½ oz. saffron, 20 ozs. alcohol.

Preparation.—Separately dissolve the colouring matter in a little alcohol, and mix together; in the remainder of the alcohol dissolve the seedlac and mix with the coloured tincture.

Copal Lacquer for Bookbinders.

Ingredients.—5 ozs. West India copal, 1 oz. mastic, 5 ozs. oil of turpentine, 5 ozs. spirits of wine. Dissolve by heat of sand bath.

Mixed Gold Lacquer.

Ingredients.—1 oz. colophony, 2½ ozs. sandarac, 2½ ozs. mastic, 1 oz. shellac, 2½ ozs. gamboge, 1 oz. turpentine, 25 ozs. oil of turpentine, 5 ozs. spirits of wine.

Preparation.—Dissolve the resin and the gamboge in the alcohol, mix the turpentine with the oil of turpentine, and then mix the solutions together.

Lacquer for Carriages.

Ingredients.—1 oz. East India copal, 1½ oz. oil of turpentine, 1½ oz. linseed oil. Dissolve the copal in the oil by heat, and then add the turpentine.

Dark Carriage Lacquer.

Ingredients.—1 part best African copal, 2¾ parts refined linseed oil, 2 parts dried sugar of lead (acetate of lead), 3 parts oil of turpentine.

Melt the copal, then add the oil and lead salt and boil until the varnish thus made commences to draw threads between the fingers, when the turpentine is added to reduce its consistence. Separately prepare a varnish, consisting of 1 part pale anime resin, 2 parts refined linseed oil, ½ part white sulphate of zinc dried, and 3 parts oil of turpentine. Melt the copal in the gumpot, add the oil and drier (*i.e.* zinc sulphate), and boil until stringy, then reduce with the turpentine. The gumpot should be removed from the fire while the turpentine is being poured in, which should be done slowly stirring the mixture all the time. Mix the two varnishes thus prepared, by boiling them up together in the gumpot and filtering while hot. This varnish dries very quickly, but it is not so durable as pure copal varnish.

No. 2. *Ingredients.*—1 lb. African copal, 3 lbs. refined linseed oil, ½ lb. litharge, 1 lb. oil of turpentine.

Preparation.—Melt the resin, add the oil and drier (litharge), boil until viscid, and reduce with oil of turpentine, which should previously be heated; filter the mixture.

Waterproof Caoutchouc Lacquer.

Dissolve the caoutchouc in linseed oil by prolonged heating, pour the solution into tall bottles, and let it stand for a few weeks to become clear. The clear solution can then be rubbed together with any kind of mineral colours, and furnishes a coating which will excellently resist the influence of the weather. When finely divided graphite is

used instead of mineral colours, a mass is obtained which in a dry state will have the appearance of steel.

Fat Resin Lacquer.

Ingredients.—5 ozs. asphaltum, 20 ozs. colophony, 10 ozs. oil of turpentine, 15 ozs. linseed oil varnish (*see* Varnish section).

Dissolve the asphaltum and colophony in the turpentine, and then add the oil.

Lacquer for Sign Painters.

Ingredients.—2 ozs. elemi, 2½ ozs. mastic, 5 ozs. sandarac, 5 ozs. shellac, 2 ozs. oil of turpentine, 2 ozs. Venetian turpentine, 50 ozs. spirits of wine.

Dissolve the resins in the alcohol, mix the two turpentines together, and then add it to the alcoholic solution.

Asphaltum Lacquer for Leather.

Ingredients.—5 ozs. mineral asphaltum, 5 ozs. tar asphaltum, 5 ozs. American pine resin, 1 oz. wax, 1½ oz. paraffine, 20 ozs. good linseed oil varnish, 1 oz. Paris blue, 5 ozs. oil of turpentine, 5 ozs. benzole, 5½ ozs. methyl violet, 5 ozs. strong alcohol.

Preparation.—Mix the methyl violet in the alcohol, and apply this to the leather before laying on the lacquer. Then mix the asphaltum, pine resin, wax, and paraffine together, and melt by heating, and to the melted mass add the linseed oil and the Paris blue; then heat the fluid, continually stirring it until it commences to give off heavy vapours. From this time samples of it must be tested. If a cooled off sample be drawn out into fine threads and leaves no fat-like edge when dropped hot upon a piece of paper, the mass is allowed to cool off as much as possible without becoming viscid, and then the oil of turpentine and benzole are added to it, and the whole well mixed by stirring.

The coat of lacquer possesses a beautiful glossy bluish-

black appearance; it is in great use under the name of military lacquer for lacquering straps, cartridge-boxes, &c.

Copal Lacquer for Mechanics.

Ingredients.—Equal parts of East India copal, oil of turpentine, and benzole.

Preparation.—Melt the copal by heating it, and then add the turpentine, and when the solution has cooled off, add the benzole. This latter volatile fluid should never be mixed with the varnish lacquers while they are hot, as it is vaporised very rapidly, and if the vapour comes in contact with a source of light an explosion will occur.

Lacquer for Iron.

Ingredients.—10 ozs. of asphaltum, 2½ ozs. colophony, 1 oz. lampblack, 25 ozs. petroleum. Dissolve.

Black Lacquer for Iron.

Melt common asphaltum in a boiler, and add rectified petroleum to it under continual stirring until a cooled off sample shows sufficient consistency to be applied with a brush. The drying of this varnish can be hastened by heat, as it will bear a high degree of heat, and, besides its beautiful black colour, possesses the valuable quality of being elastic. For articles of iron there is nothing cheaper and at the same time better protecting coat, than one of asphaltum and petroleum lacquer.

Linseed Oil and Caoutchouc Lacquer.

Ingredients.—2 parts caoutchouc, 1 part ether, 1 part linseed oil, 1 part oil of turpentine.

Preparation.—Swell the caoutchouc in the ether and render it fluid by heating, then add the linseed oil (warm) and oil of turpentine (also warm); put the mixture into a bottle to clear.

Simple Lacquer for Leather.

Ingredients.—Equal parts of caoutchouc varnish and volatile copal varnish.

Gold Lacquer for Metals.

Ingredients.—White shellac, alcohol, picric acid solution 1 per cent., crystallized boracic acid.

Preparation.—Dissolve the bleached shellac in the alcohol and mix it with so much of the saturated solution of picric acid as to give the desired gold colour to the fluid, when it is applied in a thin layer; then add the boracic acid.

Colourless Lacquer Destitute of Gloss (Hayne's Formula).

Ingredients.—56 parts ether, 24 parts benzole, 4 parts sandarac, 1 part Canada balsam.

Preparation.—First dissolve the sandarac in the ether, then add the remaining fluids and allow the mixture sufficient time to become clear.

Black Amber Lacquer for Metals.

Ingredients.—10 ozs. amber chips, 18 ozs. finest asphaltum, 10 ozs. linseed oil.

Preparation.—Melt the amber in an iron vessel, and, having boiled 5 ozs. of the linseed oil, pour it in and stir and heat to a point where they commence to evolve heavy vapours. In a separate vessel melt the asphaltum and pour the other 5 ozs. of linseed oil (boiling hot) on it; stir well, and then put both fluids into one vessel and well stir while heating together. This lacquer has the valuable quality of retaining its lustre even after frequently repeated washings, and does not crack off. In lacquering metal articles with it, they should be heated pretty hot, and the lacquer also used in the hot state, and then applied in a very thin layer. Copal may be used instead of amber. The lacquer so prepared is not so durable, although cheaper.

Gold Lacquer for Metals.

Ingredients.—1 part asphaltum dissolved in 10 parts volatile tar oil.

Black Glossy Lacquer for Metals.

Ingredients.—5 to 6 parts asphaltum, 10 parts volatile tar oil; dissolve by heat. Asphaltum dissolves very readily in volatile tar oil, and furnishes a coating for metals which adheres very tenaciously. The first of the above two recipes is especially adapted for brass, bronze, &c., and can be made of a light golden colour by suitably reducing it. The second receipt may be especially recommended to mechanics, as with it a glossy black coating can be applied on iron in a very simple manner—a coating which a strong heat does not destroy. It is advisable to apply the lacquer in a thin layer, to dry it quickly over a coal fire, and to repeat the operation till the coating is of sufficient thickness. This kind of lacquering, when rubbed, takes a very fine polish.

Wax Lacquer.

Ingredients.—10 parts white wax, 15 to 18 parts benzole.

CHAPTER XI.

LACQUERS FOR COMMONER METALS, AND METHODS OF LACQUERING THEM.

Lacquers for Brass.

No. 1. *Ingredients.*—1 oz. seedlac, 1 oz. dragon's blood, 1 oz. annatto, 1 oz. gamboge, ¼ oz. saffron, alcohol 2½ pints.

Preparation.—Dissolve the colouring matters in a little of the alcohol separately, then mix altogether in the dissolved resin and shake well to thoroughly incorporate.

No. 2. *Ingredients.*—3 ozs. shellac, 3 ozs. gum juniper, 4 ozs. turmeric, ½ oz. annatto, alcohol 3 ozs.

Preparation.—Same as No. 1.

No. 3. *Ingredients.*—3 ozs. seedlac, 1 oz. amber (powdered), 1 oz. copal (powdered), 20 grains dragon's blood, ¼ drachm extract red sanders wood, 18 grains oriental saffron, 2 ozs. coarsely powdered glass, 20 ozs. absolute alcohol.

Preparation.—Same as No. 1. The product is most excellent.

No. 4. *Ingredients.*—3 ozs. seedlac, 2 ozs. amber, ½ drachm extract red sanders wood, 2 ozs. gamboge, 1 drachm dragon's blood, ½ drachm saffron, 2 pints 4 ozs. alcohol.

No. 5. *Ingredients.*—2 ozs. sandarac, 2 ozs. elemi, 1 oz. seedlac, 6 drachms turmeric, 15 grains saffron, 6 drachms gamboge, 1 pint alcohol, hot.

Preparation.—Digest the turmeric and saffron in the whole of the alcohol, filter, and then add the other ingredients.

No. 6. *Ingredients.*—3 ozs. seedlac, 1 oz. turmeric, ¼ oz. annatto, ¼ oz. saffron, 1 pint alcohol.

Preparation.—Digest the colouring matters in the spirit for a week, then filter into a clean bottle and add the lac, and give two weeks' digestion with frequent shakings.

No. 7. *Ingredients.*—½ oz. gamboge, 1½ oz. aloes, 8 ozs. pure alcohol, 4 quarts alcohol.

No. 8. *Ingredients.*—3 ozs. seedlac, 1 oz. turmeric powder, ¼ oz. dragon's blood, 1 pint alcohol.

Preparation.—Digest altogether for a fortnight, agitating daily; then strain through muslin before using it.

No. 9. *Ingredients.*—3 ozs. seedlac, 5 ozs. alcohol, turmeric q.s.

Preparation.—Powder the lac, digest in the spirit by heat of sand-bath, and add enough tincture of turmeric to give a bright yellow colour.

No. 10. *Ingredients.*—1 oz. ground turmeric, 2 drachms saffron, 2 drachms Spanish annatto, 1 pint highly rectified alcohol, 3 ozs. seedlac.

Preparation.—Digest the colouring matters in the whole of the alcohol for several days at a moderate heat with occasional stirring, then add the lac and digest with shakings until dissolved. For a deep orange colour, add more annatto; for a bright yellow, decrease the quantity of it.

Lay the lacquer on with a brush (warm), later you could paint one or more coats as may be necessary; do not use too much seedlac, as it has a tendency to prevent the lacquer lying evenly.

Process of Lacquering Brass.

Be sure that all oil or grease is removed before laying on the lacquers. Hold the article with spring tongs or with a taper stick in some of the holes so as to avoid touching it with the fingers. Always handle the article with a piece of clean cloth. Heat the work so hot that the brush will smoke when applied, but avoid overheating, as it burns the lacquer

It is as well to fasten a small wire across the lacquer cup from side to side, to scrape off any superfluous lacquer from the brush, the ends of the hairs of which should be all exactly even. If not so, trim the ends with sharp scissors. Scrape the brush as dry as possible on the wire, making a flat smooth point at the same time. Use the very tip of the brush to lacquer with, and have a steady hand to avoid slopping. Two coats at least should be applied. To make the coat durable, it is as well to blaze off after each coat with a spirit lamp or Bunsen burner, being very careful not to overheat or burn the lacquer. If the lacquer be too thick, it will look gummy on the work; if too thin, it will show prismatic colours. In the first case, dilute with alcohol, well shaking and mixing; in the latter case, set the cup on the stove and evaporate some of the spirit. A good deal of cheap work, like lamp burners, is dipped. Use a bath of nitric and sulphuric acid, equal parts, dip the work, hang it on to the wire for a moment, then remove and rinse it thoroughly in cold water, dip in hot water, remove, put in alcohol, shake vigorously on removing to throw off extra lacquer, and lay on a warm metal plate till dry; let it cool, and the work is done. Avoid handling lacquered work until cold.

To Lacquer Microscope Work.

Use pale gold lacquer of the best quality, and see that the things are sufficiently hot before putting on the lacquer; heat after lacquering, and it will stand well. The best lacquering is affected by damp.

For Optical Work,

No. 3 recipe, above, is the best. If it comes off, either the metal was not clean when applied, or else it was put on cold. The metal should be heated to just such a point that it dries as fast as the brush passes over it. Circular things may be done in the lathe, going quite slowly, and working a good body by going over several times.

In preparing brass for the colourless or nearly colourless

brass, the articles, after being annealed, pickled, scoured and washed, are either dipped for an instant in pure commercial nitric acid, washed in clean water and dried in sawdust, or immersed in a mixture of one part of nitric acid with four parts of water till a white curd covers their surface, at which moment the articles should be withdrawn, washed in clean water, and dried in sawdust. In the first case the brass will be bright; in the latter a dead flat, which is usually relieved by burnishing the prominent parts. Then the goods are dipped for an instant in commercial nitric acid, and well washed in water containing argol, to preserve the colour till lacquered, and dried in warm sawdust.

So prepared, the articles are heated on a plate and varnished. The varnish used is one of spirit, consisting in its simple form of 1 oz. shellac dissolved in 1 pint alcohol. To this simple varnish are added such colouring substances as red sanders wood, dragon's blood and annatto for imparting richness of colour. To lower the tone of colour, turmeric, gamboge, saffron, Cape aloes and sandarac are used. The first group reddens, the second gives a yellow colour to the lacquer, while a mixture of the two gives a pleasant orange varying in tone according to the preparation of each acid.

Lacquer for Dipped Brass.

Ingredients.—4 ozs. seedlac, ¼ oz. copal, ¼ oz. English saffron, ¼ oz. annatto, 2 pints alcohol 95 per cent.

Gold-coloured Lacquer for Brass, not Dipped.

Ingredients.—1¾ lb. sandain, 6 ozs. shellac, 12 ozs. turmeric, ¾ ozs. gamboge, 1 gallon alcohol, 1 gill turpentine varnish.

Lacquer for Bronzed Brass.

Ingredients.—To 1 part of the last-mentioned lacquer add 1 oz. gamboge, and after mixing it, add an equal quantity of the finest lacquer.

Gold-coloured Lacquer for Dipped Brass.

Ingredients.—6 ozs. seedlac, 2 ozs. amber, 2 ozs. gum-gatter, 24 grains red sanders wood, 60 grains dragon's blood, 36 grains oriental saffron, 4 ozs. powdered glass, 36 ozs. alcohol.

Bronze Lacquers.

No. 1. *Ingredients.*—12 ozs. shellac, 8 ozs. sandarac, 3 quarts alcohol, dragon's blood and turmeric to produce tone required.

No. 2.—For ornaments bronzed with gold-coloured bronze, paint the articles, of cast iron, with white paint, which is white lead and oil; when hard and dry, varnish with copal varnish. When sticky dry, dust the bronze powder over it, and when hard dry brush off all the superfluous bronze with a camel's-hair brush. To protect it from the dust and soiling, coat the bronze surface, when thoroughly dry, with spirit copal varnish.

Gold-coloured Lacquer for Brass Watch Cases, &c.

Ingredients.—6 ozs. seedlac, 2 ozs. amber, 2 ozs. gamboge, 24 grains extract of red sanders wood in water, 60 grains dragon's blood, 36 grains oriental saffron, 4 ozs. powdered glass, 36 ozs. pure alcohol.

Preparation.—Infuse the saffron and red sanders wood in the alcohol for 24 hours, and having powdered all the solids and mixed them with the glass, pour the coloured alcohol over them and let them digest, then strain. Heat the metallic article before laying on the lacquer.

Lacquer for Philosophical Instruments.

Ingredients.—4 ozs. sandarac, 4 ozs. elemi, 2 ozs. best dragon's blood, 1½ oz. gamboge, 1½ oz. terra merita (terra merita is the root of an Indian plant; it is of a red colour, and much used in dyeing; invariably it is only employed in the form of a tincture, and is particularly well

adapted for the mixture of those colouring parts which contribute the most towards giving metals the colour of gold; in choosing it, be careful to observe that it is sound and compact), 4 grains oriental saffron, 2 ozs. seedlac, 6 ozs. powdered glass, 40 ozs. pure alcohol; the dragon's blood, elemi, seedlac, and gamboge are all pounded and mixed with the glass, over them is poured the tincture obtained by infusing the saffron and terra merita in the alcohol for twenty-four hours. This tincture, before being poured over the dragon's blood, should be strained through a piece of clean linen cloth and strongly squeezed. If the dragon's blood gives too high a colour, the quantity may be lessened according to circumstances. The same is the case with the other colouring matters. This lacquer has a very good effect when applied to many cast or moulded articles used in ornamenting furniture.

Green Transparent Lacquers.

Ingredients.—1 quart strong vinegar, ½ oz. mineral green, ½ oz. raw water, ½ oz. sal-ammoniac, ½ oz. gum-arabic, 2 ozs. French berries, ½ oz. copperas.

Preparation.—Dissolve the above in an earthenware pipkin over a full fire, allow to cool, and then filter.

Method of Lacquering Instruments.

Clean the brass-work of instruments by boiling in caustic soda water if convenient, and then soak in alcohol and wipe. For aluminium lacquer, dissolve bleached shellac in 95 per cent. alcohol. Heat all the work to 212° F. before applying the lacquer, use a broad camel's-hair brush, work quickly, and place the work in a hot oven or over a spirit-lamp for a few minutes to glaze the surface of the lacquer. To deaden the gloss on instrument work: clean perfectly free from grease with soda water, wash and dip in a bath of 1 part nitric acid and 49 water for from two to five seconds, wash off the acid in hot water, dip again in hot soda water, and in hot clean water to leave the surface perfectly free

from acid. Dry in sawdust. Colour lacquering with dragon's blood and saffron to the required depth.

Operation of Lacquering.

Have the lacquer in a jar with a wire across the top, so as to allow the surplus lacquer being squeezed off the brush by scraping it against the wire just as you would against the edge of a cup. The wire should be kept clean to keep it from clogging. Do not make the brasswork too hot, but warm until the sweat or steam disappears. To obtain the rich colour, put on successive coats of lacquer, warming the article between each. Do not try to do this in one operation, and so lay it on too thick. Hold the brush between the thumb and finger of the right hand, and apply by light feather strokes. Suitable holders should be made for round work, terminals, &c., whereby they can be twisted round between finger and thumb of the left hand. If the work is made too hot, the lacquer will turn brown and have to be washed off; this is accomplished by using spirit, or by leaving the article in strong solution of soda over night. The brushes used should be of soft camel-hair, flat, and trimmed on a board with a sharp knife to a thin straight edge. A good brush is half the battle. If these get hard, press on a hot iron plate and then dip in lacquer, when they will be in nice working order.

To Re-lacquer Brass.

Strong sulphuric acid 2 parts, water 1 part, red fuming nitrous acid 1 part. Mix these in the open air, as the gas evolved on mixing the nitrous acid with the sulphuric acid and water is of a suffocating character. This will pass off in the course of an hour or so, during which time the mixture may be stirred with a glass rod. The bright gilded effect produced on the brass by this mixture is so good that any one trying it will not return to the use of nitric acid. The subsequent washing, drying, and lacquering cannot be done too soon after the dipping, as the articles tarnish rapidly if kept unlacquered.

To Clean and Re-lacquer Brass Chandeliers.

Remove all parts that can be removed, and thoroughly free from all grease by washing in a strong solution of pearl ash until apparently clean, scraping off any corrosions; treat the fixed parts in the same way. All the parts that will permit doing so should be boiled in the alkaline solution, then treat all the parts with a solution of nitric acid, 1 part to 3 or 4 parts of water. The movable parts should remain in this solution for an hour (of course, if the chandelier can be taken down, all the parts should be thus treated); afterwards wash them well, and scour with sand if necessary until every part is clean, then make up a solution of equal parts of nitric and sulphuric acids, and add to it about one-third extra of nitric acid, having zinc dissolved in it in the proportion of about 1 part zinc to 3 of acid. When boiling, dip the articles in it until they have the colour you require, and twenty to thirty seconds will be ample. Then swill well in plenty of water, and place all the parts in fine sawdust until dry. When dry, rub up with soft rag and leather, and when just too hot to hold lacquer the whole of the parts that will be at all exposed. When going through the process above, take care not to handle any of the brasswork; and above all do all the work out of doors, or in a place with a large chimney, to take away any fumes of nitrous acid, which are extremely injurious to inhale.

Lacquer for Iron.

No. 1. *Ingredients.*—10 ozs. asphaltum, 3 ozs. resin, 1 part lamp-black, 25 ozs. petroleum.

No. 2. *Ingredients.*—2 ozs. amber, 12 ozs. turpentine, 2 ozs. resin, 2 ozs. asphaltum, 6 ozs. drying oil.

No. 3. *Ingredients.*—3 lbs. asphaltum, ½ lb. shellac, 4 quarts turpentine.

Lacquer for Bright Iron.

Ingredients.—4½ parts litharge, 64½ parts boiled linseed oil, 9 parts white lead in oil, 2⅕ parts resin powder.

Preparation.—Add the litharge to the oil, and let it simmer for about 3 hours over a moderate fire, strain, and add the resin and white lead. Let it remain at a gentle heat until the resin is dissolved.

Lacquering Metallic Surfaces.

For Gold Surfaces.

Ingredients.—4 ozs. turmeric, 1 oz. gamboge, 3 ozs. shellac, 14 ozs. sandarac, 1 pint common turpentine varnish, 2 quarts alcohol.

Preparation.—Macerate the turmeric in the alcohol for a week, then add the other solid ingredients and dissolve by heat of a water-bath, and, finally, add the turpentine varnish. The above is a yellow lacquer. For a red one, use 14 ozs. annatto instead of the turmeric, and 4 ozs. dragon's blood instead of the gamboge.

No. 2. Pale. *Ingredients.*—½ oz. turmeric, ¾ drachm dragon's blood, 1 scruple red sanders-wood, 2 scruples hay saffron, 1 oz. shellac, 2 ozs. sandarac, 2 drachms mastic, 2 drachms Canada balsam, 1½ drachm spirits of turpentine, 8 ozs. alcohol.

Preparation.—Dissolve the colouring matter in the alcohol, then put in the resin, and when dissolved add the turpentine.

No. 3. *Ingredients.*—12 ozs. seedlac, 4 ozs. copal, 80 grains dragon's blood, 50 grains of extract of red sanders-wood, 70 grains saffron, 8 ozs. pounded gum, 9 quarts alcohol. Prepare as the last.

No. 4. Pale gold.—5 ozs. seedlac bruised, ¼ oz. of red sanders-wood, ½ gallon methylated alcohol,

No. 5.—A paste is made of finely pulverised quartz, carbonate of potash (or oxide of lard), and water according to the colour required. A thin coat of this is applied with a brush to the object, which is then placed in a muffle and heated to 1·495°. F. (811° C.). The articles when

taken out are covered with a sort of polished glass, which resists blows and which does not split nor scale off, while it serves perfectly to protect the metal against oxidation.

No. 7. *Ingredients.*—1 lb. petroleum essence (vaseline), ½ lb. boiled linseed oil.

Preparation and Use.—Mix cold, and when it is brushed over (applied cold) metallic plates prepared for lithography, &c., and dried by heat, it has a golden-yellow tint.

Green Varnish for Metals.

Make a resinate of sandarac or mastic by dissolving the powdered resin in strong potash lye until it will dissolve no more, then dilute the solution with water, and precipitate with a copper salt, either sulphate (blue vitriol) or acetate (verdigris). Wash the green precipitate thus obtained dry, and pulverise it in oil of turpentine. The result is a fine green varnish which does not change under the effect of light, and will be especially useful for ornamental ironwork.

Pale Tin Lacquers.

Ingredients.—2 drachms powdered turmeric, 1 scruple hay saffron, 2 scruples dragon's blood in powder, ½ scruple red sanders-wood, 4 ozs. alcohol, ½ oz. sandarac, 1 drachm mastic, 1 drachm Canada balsam, 40 drops spirits of turpentine.

Preparation.—Digest all the ingredients that are mixed before the alcohol in that fluid for 48 hours, then pour off the clear liquid and strain the remainder, and to the clear and strained fluid mixed add the resins and balsam; let them dissolve by rest and frequent agitation, and when dissolved put in the spirits of turpentine.

Gold Lacquer for Tin Plate.

Clean the tin plate carefully, and apply the following mixture with a brush: 3 parts dried copal lacquer, 1½ part linseed oil. Dry the plates; then lacquer. Will not crack nor lose its lustre if the tin plates are bent or hammered.

Lacquer for Tin Plate.

No. 1. *Ingredients.*—6 drs. turmeric, 3 scruples saffron, 3 drs. sandarac, 3 drs. Canada balsam, 4 drs. mastic, 120 minims of oil of turpentine, alcohol 12 ozs.

Preparation.—Dissolve the first five ingredients in the alcohol, then add the turpentine.

No. 2. *Ingredients.*—1 part alcohol, ½ oz. red sanderswood, 1 oz. turmeric, 2 ozs. shellac.

No. 3.—Use as a body shellac, or sandarac varnish, to make it adhere; add to it ½ part boracic acid to 1,000 parts lacquer. Colour with suitable pigments, such as Prussian blue, carmine, gamboge, or other turpentine colours. Aniline colours may be used, but they fade. By adding a little castor oil, the lacquer becomes tougher and more pliable.

Red Lacquer for Tin Ware.

Ingredients.—1 part alcohol, 3 ozs. seedlac, 2 drs. aniline colours to suit.

Preparation.—Mix, and let the whole remain for a couple of weeks, agitating at least once a day; when properly combined strain the fluid through muslin.

Lacquer for Tinfoil.

Ingredients.—5¼ ozs. shellac, 1½ pint alcohol, 2⅝ ozs. best white gum elemi, 10½ drs. Venetian turpentine.

Preparation.—Dissolve the shellac in the alcohol, and filter; do not let the alcohol evaporate too much, or the lacquer will become too thick; then add to the solution of shellac the elemi and turpentine. Let the mixture stand in a warm place, stirring frequently. Filter, press only the remainder, and add to the filtrate. This lacquer may be coloured if desired.

Lacquer for Steel.

Ingredients.—8 parts mastic, 4 ozs. camphor, 12 ozs. sandarac, 4 ozs. elemi, alcohol 9 ozs.

Preparation.—Dissolve and filter. Use the lacquer cold; it will be clear and transparent when dry.

Lacquer for Zinc.

Ingredients.—1 oz. gamboge, 3 ozs. shellac, 1 oz. annatto, solution of 3 ozs. seedlac in 1 pint alcohol, ¼ oz. Venetian turpentine, ¼ oz. dragon's blood, 8 ozs. alcohol.

Preparation.—Add the turpentine and dragon's blood when the other bodies are dissolved; put in a warm place for four or five days.

Gold Lacquers.

No. 1.—Pale lac in grains, gamboge and dragon's blood, and annatto, each 12½ ozs., saffron 3¼ ozs. Each gum is dissolved separately in 5 pints of alcohol, and the annatto and saffron are separately infused in a like quantity of alcohol. The ingredients are mixed to form any particular tint desired. Turmeric (ground) 1 lb., alcohol 2 gals. Macerate for one week, strain by expression, and add gamboge 1½ oz., pale shellac ¾ lb., gum sandarac 3½ lbs. Strain, and add turpentine varnish 1 quart. Other lacquers are prepared in a similar way from alcohol and shellac. A solution of the colouring ingredients, as dragon's blood, gamboge, &c., being kept on hand, and added to, produce every desired tint.

No. 2.—Two parts seedlac, 4 parts sandarac, 4 parts elemi, 40 parts alcohol, alcoholic solution of gamboge, and dragon's blood, or fuschine picric acid. Martin's yellow and coralline are separately prepared and added to the above in quantities ascertained by trial to impart the desired colour. To remove the remains left by the brush, and to impart lustre, the varnish, after drying, is polished. This is effected by first rubbing with powdered pumice and water, and next with the oiled rag of Tripoli until the desired polish is produced. The surface is afterwards dried with a soft linen cloth. Any greasiness is removed by means of powdered starch, and the process is finished by rubbing with lard. Great care must be taken that the sur-

face to which varnish is applied is free from grease or smoke, which prevents all oil varnish from drying.

No. 3. *Ingredients.*—1 dr. turmeric, 1 dr. gamboge, 2 pints oil of turpentine, 5 ozs. shellac, 5 ozs. sandarac, 7 drs. dragon's blood, 8 ozs. thin mastic varnish.

Preparation.—Digest with occasional shaking for a fortnight in a warm place, then set aside to fine, and pour off the clear.

No. 4.—Dissolve gum lac in 90 per cent. alcohol.

No. 5. *Ingredients.*—8 ozs. turmeric, ground, ¾ oz. gamboge, ground, 24 ozs. sandarac, ground, 8 ozs. bleached shellac, ground, 4 quarts alcohol, 1½ pint turpentine varnish.

Preparation.—Put the whole in a suitable vessel, shut close and agitate until dissolved.

No. 6. *Ingredients.*—5 ozs. seedlac crushed, ¼ oz. red sanders wood, 2 quarts methylated spirit. Dissolve and strain.

CHAPTER XII.

VARNISHES AND JAPANS.

Varnishes and Japans for Metal Workers.

Black Varnish for Tinsmiths.

Fine lampblack or Frankfort black ground up with spirit, and added to an alcoholic solution of shellac or else to a solution of 1 part of asphaltum, digested in 3 parts of oil of turpentine, and then add some linseed oil and minium.

Gold Varnish for Iron.

Ingredients.—90 parts or more of linseed oil, 60 parts of tartar, 60 parts of hard-boiled yolk of egg, 15 parts of aloes, $\frac{1}{4}$ part of saffron, and $\frac{1}{10}$ part of turmeric. Digest all together, and when fluid apply to the iron.

Black Varnish for Zinc.

Ingredients and Preparation.—Equal parts of chlorate of potash and sulphate of copper. Dissolve in 36 times as much warm water, and allow the solution to cool. If the sulphate of copper used contains iron, it is precipitated as a hydrated oxide, and can be removed by decantation or filtration. Then dip the cast-zinc article in the solution until quite black; rinse off in water, and dry. Even before it is dry the black coating adheres to the article, so that it may be wiped dry with a cloth. If coffee-coloured spots appear during the operation, the solution is applied to them a second time, and after a while they turn black, when the

article should be washed and dried. On rubbing, the coating acquires a glittering appearance like indigo, which disappears on applying a few drops of linseed oil varnish, or "wax milk," and the zinc then has a deep black appearance, and gloss. The wax milk is prepared by boiling 1 part of yellow soap and 5 of Japanese wax in 21 of water until the soap dissolves. When cold it has the consistency of a salve, and will keep in closed vessels for an indefinite time. It can be used for polishing carved wood, and for waxing ball-room floors, as it is cheaper than the solution of wax in turpentine, and does not stick or smell disagreeably like the latter.

Black Varnish on Iron and Steel.

A beautiful black polish is obtained by boiling 1 part of sulphur with 10 of oil of turpentine, but it has a disagreeable odour. A coat, as thin as possible, is laid on the article to be polished, which is then held over the flame of an alcohol lamp until the black polish makes its appearance.

Anti-corrosive Varnish for Spring Steel.

Bars of spring steel, if coated with the following preparation, are not acted upon by acids, alkalies, chlorine, or steam :—50 parts china clay, 10 of sandarac, 3 of elemi, 2 of gun-cotton, $\frac{1}{2}$ of camphor, and 5 of oil of lavender (from *Lavandula spica*); the whole mixed with 100 parts of alcohol.

Method of Application.—First coat the bars with copal or asphaltum lacquer, and dry at a high temperature. Then wrap them in several layers of strongly-pressed paper, impregnated with chromium glue, and subjected to a very strong pressure. Then put on the coat of the above compound, and when half dry subject the bars again to pressure, and, when entirely dry, grind.

Gold Lac Varnish for Leather and Metal.

Ingredients.—$8\frac{3}{4}$ ozs. seedlac, $8\frac{3}{4}$ ozs. sandarac, $3\frac{1}{2}$ ozs. gamboge, $\frac{1}{2}$ oz. Venetian turpentine, ·07 oz. oil of turpentine.

Preparation.—Digest the resins in the Venetian turpentine, the gamboge in the oil of turpentine. Mix the two, and heat by the aid of a water-bath.

Black (Amber) Varnish for Metals and Coachmakers.

Ingredients.—1 lb. amber, ½ pint hot drying oil, 3 ozs. powdered black resin, 3 ozs. Naples asphaltum, 1 pint oil of turpentine.

Preparation.—Fuse the amber; add the drying oil hot, then the resin and asphaltum; and when perfectly incorporated and cool add the oil of turpentine.

Black Varnish for Ironwork.

Useful for the ironwork of carriages, and other similar purposes.

Ingredients.—12 lbs. asphaltum, 2½ gallons boiled oil, 1¾ lb. red lead, 1¾ lb. litharge, ¾ lb. dried and powdered white copperas, 2 lbs. dark amber (fused), 2 quarts best linseed oil, 7½ gallons oil of turpentine.

Preparation.—Fuse the asphaltum, and add the boiled oil and driers (litharge, red lead, and zinc sulphate—*i.e.* white copperas). Boil the mixture for 2 hours; then add the fused amber and hot linseed oil, and boil for two hours longer, or till a little of the mass, when cooled, may be rolled into pills; then withdraw the heat, and afterwards thin down with oil of turpentine.

Black Japan.

Ingredients.—12½ lbs. Naples asphaltum, 2 lbs. dark anime resin, 3 gallons linseed oil, 2½ lbs. dark amber resin, 2 quarts linseed oil, driers as in the last recipe.

Preparation.—Fuse the asphaltum and anime; add the first quantity of linseed oil. Boil, and then add the amber resin, having previously fused it and boiled with the 2 quarts of linseed oil. Put in the driers and proceed as in last recipe. Used for wood and metals.

Anti-rust Varnish.

Ingredients.—12 parts resin, 18 parts sandarac, 6 parts gum lac, 12 parts essence of turpentine, 10 parts rectified alcohol.

Preparation.—Powder the first three ingredients, and digest them by a regular heat until melted; then add the turpentine, very gradually stirring all the while. The mixture should be digested until the resins are dissolved; then add the alcohol. Filter through fine cloth or thick bibulous paper, and preserve in well-stoppered bottles or Noakes' paint tins.

Asphalt Varnish for Metals.

No. 1.—Boil ordinary tar until on cooling it shows a tendency to harden; add about $\frac{1}{5}$ asphaltum, shaved fine, until all is melted, then cool.

No. 2.—Boil coal-tar until it shows a disposition to harden on cooling. To ascertain this, rub a little on a piece of metal; then add about 20 per cent. of lump asphalt, stirring it with the boiling tar until all the lumps are melted, when it can be allowed to cool and kept for use. This makes a very bright varnish for sheet metals, and is cheap and durable.

Asphalt Varnish for Microscopists.

Ingredients and Preparation.—Dissolve $\frac{1}{2}$ drachm caoutchouc in mineral naphtha, and then add 4 ozs. asphaltum, using heat if necessary.

Bronze Varnish for Small Castings.

Ingredients.—10 parts diamond fuchsine, 5 parts Hofmann's methyl violet are dissolved in water or sand-bath in 100 parts alcohol 95 per cent.; then add 5 parts benzoic acid, and boil for five to ten minutes, until the whole has acquired a brilliant bronze colour. This varnish adheres firmly to all articles, possesses a beautiful gloss, and is very durable.

Varnish for Bronze Statuary.

Cut best hard soap, 50 parts, into fine shavings; dissolve it in two parts of water, with a solution of sulphate of copper, made by dissolving 15 parts of blue vitriol in 60 parts of water. Wash with water, dry slow, dissolve in turpentine.

Varnish for Chimneys and Stove Pipes.

Ingredients and Preparation.—2 lbs. asphaltum, 1 pint boiled linseed oil, 2 quarts oil of turpentine. Fuse the asphaltum in an iron pot, boil the linseed oil, and add while hot. Stir well, and remove the mixture from the fire; when partially cooled add the oil of turpentine.

Asphalt Varnish for Machinery.

Ingredients.—3 ozs. asphaltum, 4 quarts boiled oil, 8 ozs. burnt umber.

Preparation and Use.—First paint the articles in the above Japan colour mixed by heat, and when cooling thin with turpentine; then coat them with a suitable transparent or light varnish.

Varnishes for Metals.

No. 1. *Ingredients.*—1 part copal, 2 parts alcohol. Dissolve by heat.

No. 2. *Ingredients.*—1 part copal, 2 or 3 parts oil of rosemary, alcohol q.s. Dissolve, and apply hot.

Varnish for Iron and Steel.

Ingredients.—2 ozs. mastic, 1 oz. camphor, 3 ozs. sandarac, 1 oz. elemi. Apply cold.

Varnish for Polished Metals.

"Take bleached shellac pounded in a mortar, place the bruised fragments into a bottle of alcohol until some shellac remains undissolved; agitate the bottle and contents fre-

quently, and let the whole stand till clear: pour off the clear fluid; this forms the varnish. Warm the metal surface, and coat with a camel-hair brush. If not perfectly transparent, warm the varnished surface before a fire or in an open oven until it becomes clear. Common orange shellac answers equally well, and for large surfaces even better, as it is more soluble than the bleached variety, and coats more perfectly; but care must be taken not to use the varnish insufficiently diluted."

No. 2.—Digest 1 part of crushed copal in 2 parts of absolute alcohol; but as this varnish dries too quickly, it is preferable to take 1 part of copal and 2 or 3 parts of absolute alcohol as above; this gives a clear varnish, as limpid as water. It should be applied hot, and when dry it will be found hard and durable.

Varnish for Mechanics.

Ingredients.—5 ozs. resin, 1 oz. dragon's blood, 1 oz. gamboge, 2 ozs. gutta-percha, 1 part shellac, 40 parts volatile tar oil. This lacquer is very useful, and largely used for many purposes.

Varnish for Metal Surfaces.

To make alcoholic lacquering or varnishes adhere more completely to polished metal surfaces 1 part of boracic acid should be added to 200 parts of varnish. This composition will adhere so firmly and become so completely glazed, as to be removed with difficulty. Be careful not to add too much of the boracic acid, as it injures the gloss in that case.

Metallic Varnish.

Ingredients.—16 ozs. grain tin is melted with 4 ozs. bismuth, and 4 ozs. mercury added, and the whole stirred till cold; now grind it very fine with varnish or white of egg. This mixture is sometimes called varnisher's amalgam.

Varnish for Foundry Patterns and Machinery.

"A varnish has been patented in Germany for the above purpose, which it is claimed, dries as soon as put on, gives the pattern a smooth surface, thus insuring an easy slip out of the mould, and which prevents the patterns from warping, shrinking, or swelling, and is quite impervious to moisture. This varnish is prepared as follows :—30 lbs. shellac, 10 lbs. Manila copal, and 10 lbs. Zanzibar copal are placed in a vessel which is heated externally by steam, and stirred during four to six hours, after which 150 pints of the finest potato spirit are added to the whole, heated during four hours to 87° C. This liquid is dyed by the addition of orange colour, and can then be used for painting the patterns.

No. 2.—When used for painting and glazing machinery, it consists of 35 lbs. shellac, 5 lbs. Manila copal, 10 lbs. Zanzibar copal, and 150 lbs. alcohol.

Ordinary Varnish for Patterns.

Ingredients.—8 ozs. shellac, 2 quarts alcohol, lump of ivory black sufficient to colour it.

Varnish for Silver Ware.

Ingredients.—3 ozs. gum-elemi, $4\frac{1}{2}$ ozs. white amber, 3 ozs. charcoal, $37\frac{1}{2}$ ozs. spirits of turpentine. Mix all together, and use hot, the metal also being heated.

Tar Varnish.

No. 1. *Ingredients.*—$1\frac{1}{2}$ gallon coal tar, $\frac{3}{4}$ pint spirits of turpentine, 3 ozs. oil of vitriol.

Preparation.—Mix the tar and sulphuric acid together, and apply with a brush, as it becomes thick.

No. 2.—Heat tar to 156° F., and mix with it equal parts of hydraulic lime and Roman or Portland cement. The mixture is a thin fluid; when dry it is soft and flexible.

This varnish prevents wood from rotting; especially good for wood under water and for shingles.

Tinner's Varnish.

No. 1.—Mix lampblack with shellac.

No. 2.—Mix Frankfort black with a mixture of asphaltum and oil of turpentine, then add a little linseed oil and minium; the exact proportions of tinner's varnishes are immaterial.

Varnish for Tools.

Ingredients.—4 ozs. tallow, 2 ozs. resin; melt and strain while hot. Apply a coat with a brush to the tools, and it will prevent them rusting.

Black Varnish.

No. 1.—*Ingredients and Preparation.*—In an iron pot, over a slow fire, boil 45 lbs. of foreign asphaltum for at least six hours, and during the same time boil in another pot 6 gallons of oil which has been previously boiled; during the boiling of the 6 gallons introduce 6 lbs. of litharge gradually and boil it until it feels stringy between the fingers; then ladle it into the pot containing the boiling asphaltum. Let both boil until upon trial it will roll into hard pills, then cool and mix with 25 gallons of turpentine, or until it is of a proper consistency.

No. 2.—The following black japan is suitable for covering surfaces when a japanned surface has been injured or scratched. Fine lampblack or ivory-black thoroughly mixed with copal varnish; the black must be in fine powder, and it would mix the more readily if made into a pasty mass with turpentine.

Black Varnish for Coach-work.

Ingredients and Preparation.—7½ ozs. asphaltum, 4 ozs. amber, 7½ ozs. resin, 1¼ pint drying linseed oil.

Melt together in an iron pot; when pretty cool, add warm oil of turpentine, 1¼ pint.

Black Varnish for Coal Buckets.

Ingredients.—1½ lb. asphaltum, ⅜ lb. lampblack, ¾ lb. resin, 1½ quart spirits of turpentine.

Dissolve the resin and asphaltum in the turpentine, form a paste with the lampblack and linseed oil q.s. Mix with the other; apply with a brush.

Black Varnish for Zinc.

No. 1. *Ingredients and Preparation.*—Dissolve 2 parts of nitrate of copper, and 3 parts of crystallised chloride of copper in 64 parts of water, and add 8 parts nitric acid. (This is Böttzer's formula.)

No. 2. *Ingredients and Preparation.*—Dissolve equal parts of potassic chlorate and cupric sulphate in 36 times as much water; warm, and leave the solution to cool. Immerse the articles in the solution, and when black, rinse with water and dry.

Brunswick Black.

No. 1. *Ingredients.*—25 lbs. black pitch, 25 lbs. gas-tar asphaltum; boil gently for 5 hours, then add 8 gallons linseed oil, 10 lbs. litharge, 10 lbs. red lead; boil, and when cooled a little, thin with 20 gallons oil of turpentine.

No. 2.—Many recipes for making this varnish do not mention the secret, *viz.*, to boil the asphaltum until all the moisture is driven off. Take 7 lbs. pitch and 7 lbs. asphaltum; boil in an iron pot for 7 to 10 hours with frequent stirring; when all the moisture is out, add 2 gallons boiled oil previously heated, then add 2½ lbs. red lead, and 2½ lbs. litharge, and boil for 3 hours or until some of it will set hard. Then let it cool down, and add 5 gallons turpentine, or as much as will reduce it to the consistence best suited to your work. This varnish should dry in twenty minutes to one hour, according to the state of the atmosphere; you

can try leaving out the red lead, but add the extra in asphaltum, and also vary the quantity of the oil; if wanted good and cheap, and 24 hours will suit, add more oil, less turps.

Formulæ for producing Volatile and Fat Varnishes.

General Notes concerning Varnishes.

A varnish is a body which dries on the surface of the material on which it is laid, leaving a film which is usually glossy. This varnish film forms a protective covering to the surface, so as to shield it from injurious influences, and to give it an ornamental appearance. There are two kinds of varnish, technically called fat and volatile. The fat varnishes are those which form a film by the solid drying of the varnish constituent, and the volatile varnishes are those which deposit a film and become hard and dry by the evaporation of some of the constituents. The fat varnishes are also called oil varnishes, because they are made with linseed oil and a hard resin, while the volatile varnishes are called spirit varnishes, because the solvent for the resin is a volatile spirit, like spirits of wine, naphtha, &c. The latter class of varnishes have a wider range of applicability than the oil varnishes, and they moreover are easier to prepare, as they do not need special expensive plant, nor the skill and attention that oil varnishes require.

The following are the qualities to be taken into account in estimating the value of a varnish:—

(*a*) Quickness in drying.
(*b*) Hardness of film or coating.
(*c*) Toughness of film.
(*d*) Amount of gloss.
(*e*) Permanence of gloss of film.
(*f*) Durability on exposure to weather.

Ingredients of Varnishes.—The ingredients of varnishes are resins—technically called gums—and solvents for same.

In the early part of this work we give in alphabetical order the characteristics of the particular gums and solvent fluids.

Although a resin is called a gum by the varnish-maker, it is improperly so called, because a gum, properly speaking, is soluble in water, and therefore unfit to use in varnish-making, while resins dissolve only in spirits or oil.

Gum resins or balsams are natural mixtures of gum with resin, and sometimes with essential oil, found in the milky juice of the plants. When rubbed up with water the gum is dissolved, and the oil and resin remain suspended. Consequently balsams are partly soluble in water, partly so in alcohol; or, in other words, they take both alcohol and water to perfectly dissolve them.

A resin is the inspissated or thickened juice of plants. Resins are generally mixed with an essential oil, are insoluble in water, but are soluble either in ether, alcohol, or the essential oils. Their general characteristics are inflammability and fusibility; their ultimate components are carbon, oxygen, and hydrogen.

The hard resins are chiefly used in making fat varnishes, while the softer ones are used in spirit varnish-making.

In making a varnish the solvent must be suited to the description of resin it is intended to dissolve. Amber, anime, or copal resins are dissolved in boiling linseed oil (or an essential oil like rosemary). Mastic, dammar, and common resins are dissolved by turpentine (also by other volatile fluids). Methylated spirits of wine is generally used for lac and sandarac, while for cheap varnishes wood-naphtha is frequently used. This fluid dissolves the resin more readily than ordinary spirits of wine, but the varnish then made is less brilliant, and the smell of the naphtha is very offensive, hence its non-employment in the production of the superior kinds of varnish.

Many varnishes are required to dry quicker than they do in the normal state, therefore driers are added when making the varnish, so as to increase the quickness with which the varnish shall dry. These driers are generally added in the form of litharge, sugar of lead, or white copperas. Sugar of lead not only hardens, but combines with the oil in the varnish to form a lead-soap—linoleate of lead. The skilled

varnish-maker uses driers very judiciously, as a large proportion of driers injures the durability of the varnish, though it causes it to dry more quickly.

The resins to use for *body and lustre* are amber, anime, copal, elemi, lac, mastic, and sandarac.

For *odour* (for pleasant-smelling varnishes), benzoin.

For *colour and body*, asphaltum. This is not a resin.

For *toughness and elasticity*, caoutchouc.

For giving colour to varnishes the following bodies are used:—Annatto, gamboge, saffron, Socotrine aloes, turmeric, dragon's blood, new sandal-wood, cochineal, indigo.

Lacquers is the term generally given to those spirit varnishes which are used for metal.

In the following collection of recipes we give formulæ for producing varnishes for nearly all purposes where they are required by mechanics. All the recipes, with the exception of those for oil varnishes and japans, are such as can be followed by the amateur and require very little apparatus. As oil varnishes and japans require special appliances, we have not done more than give recipes for such productions, as the details as to apparatus and method of using would increase the bulk of this book, without any commensurate advantages, as such details would be available by manufacturers only, and *ipso facto*, useless, as their workmen would be fully conversant with all such details. However, so that both amateurs and manufacturers alike shall find this book serviceable to them, we give recipes for oil varnishes and japans, together with such general details of the process as will render the *modus operandi* intelligible to the inexperienced.

Varnishes for Woodwork in general.

Spirit Varnish for Woodwork.

No. 1. *Ingredients and Preparation.*—40 ozs. sandarac, 4 ozs. Venetian turpentine, 12 ozs. of alcohol.

Dissolve them in the alcohol and add the turpentine. Filter.

No. 2. *Ingredients and Preparation.*—24 ozs. sandarac, 16 ozs. mastic, 2 ozs. Venetian turpentine, 12 ozs. spirits of wine.

Dissolve and mix as before.

No. 3. *Ingredients and Preparation.*—48 ozs. sandarac, 24 ozs. mastic, 1 oz. Venetian turpentine, 12 ozs. alcohol. Prepared as No. 1.

Pliable Sandarac Lac Varnish for Wood.

Ingredients.—13·12 ozs. sandarac, 4·37 ozs. elemi, 4·37 ozs. anime, 1·05 oz. camphor, $2\frac{3}{4}$ lbs. alcohol 90 per cent.

Preparation.—Dissolve the resins by pouring the alcohol over them and digesting in a flask by the heat of a sand bath. Filter.

Sandarac Varnish for Furniture.

Ingredients.—13·12 ozs. sandarac, 4·37 ozs. mastic, $8\frac{3}{4}$ ozs. powdered glass, ·35 oz. alcohol 90 per cent., $2\frac{1}{2}$ ozs. Venetian turpentine.

Preparation.—Powder the resins, and mix them with the glass, and then dissolve in the alcohol by heat, and add the turpentine when the resins are dissolved. Filter through cotton-wool.

English Bed-Furniture Varnish.

Ingredients.—7 ozs. sandarac, $4\frac{1}{3}$ ozs. refined shellac, $4\frac{1}{3}$ ozs. colophony, 1 oz. dragon's blood, 53 ozs. alcohol, $\frac{3}{4}$ oz. Venetian turpentine.

Preparation.—Powder all the solids, digest them in the alcohol, and dissolve by heat of sand bath, then add the Venetian turpentine.

Dutch Furniture Varnish.

Ingredients.—37½ parts sandarac, 12½ parts refined shellac, 25 parts colophony, 25 parts Venetian turpentine, 250 parts alcohol, 25 parts powdered glass.

Preparation.—First dissolve the shellac in the alcohol and filter, then mix the glass with the other bodies, which should be powdered, and dissolve in the shellac varnish.

Volatile Copal Varnish.

No. 1. *Ingredients.*—6 ozs. copal, 1 oz. ether, 6 ozs. alcohol, 4 ozs. oil of turpentine. Digest altogether.

No. 2. *Ingredients.*—Copal 1 oz., acetone 3 ozs.

Preparation.—Acetone is only useful as being a very ready solvent for copal, but it is no use in the made varnish, as it dries too quickly (the boiling point of this fluid is 56° C., *i.e.* 132·8° F.). The clear solution is carefully distilled at a low temperature until about 15 to 20 parts of the acetone pass over, then, immediately after the distillation is interrupted, spirits of wine, 90 per cent. strong, is added to the warm viscid solution. Ether may also be used instead of acetone. If this fluid is used, as much spirits of wine is at once put in the alembic as it is desired to distil off of ether. When this is heated to from 34° to 36° C. (93·2° to 96·8° F.) ether only passes over—in these cases the cooling pipe of the distilling apparatus must be surrounded with ice, and the ether can be again used.

No. 3. Elastic copal varnish.

Ingredients.—1 oz. camphor, 4 ozs. copal, 12 ozs. ether.

Preparation.—A very long time is required to permit this mixture to become clear. After several weeks standing pour off the top clear portion; and the thick portion, on which the swelled-up copal is, mix with ½ to ¾ oz. camphor, 2 ozs. copal, and 12 ozs. ether, and again digest.

Varnish for Imitation Gilt Cornices.

Ingredients and Preparation.—52½ ozs. of shellac dissolved in 3·15 quarts alcohol. Allow the solution to clear by

standing undisturbed, and separately make a solution consisting of 8¾ ozs. sandarac, 7 ozs. mastic, 8¾ ozs. gamboge, 1¾ oz. dragon's blood, alcohol q.s.

Dissolve the two colouring matters (gamboge and dragon's blood) separately in a small quantity of alcohol, and also dissolve the sandarac and mastic in alcohol, then mix the tinctures of the colouring matters in the quantities to produce the hue of colour required, using more gamboge for a yellower tone, and more dragon's blood for a reddish tone; then mix this solution and the shellac solution together. For a thicker varnish, dissolve the sandarac and mastic in the solution of shellac after that has cleared.

Varnish for Gilt Cornices.

Ingredients.—42 ozs. shellac, 17½ ozs. sandarac, 8¾ ozs. gamboge, 7 ozs. sanders wood, 5¼ ozs. turpentine, 5¼ quarts alcohol.

Digest the sanders wood in a pint of the alcohol, and add it to the solution formed by dissolving the other components in the remainder of the alcohol.

Dead Ground for Imitation Gilt Wood.

Ingredients.—8¾ ozs. bleached shellac, 8¾ ozs. whiting, 2½ quarts spirits of wine.

Preparation.—Dissolve the shellac in as small a quantity of the alcohol as possible, then quickly rub this together with the whiting into a dough, and gradually add the remainder of the spirit. If the varnish should have a glossy appearance after it has become dry, add some alcohol and whiting, but should it be too dead, a small portion of a thick solution of shellac has to be added. Finally it receives a thin coat of a colourless solution of shellac.

Varnish for Gilt Mouldings.

Ingredients.—2½ ozs. amber, 2 ozs. dragon's blood, 2½ ozs. gamboge, 10 ozs. seedlac, 1 oz. saffron, 3 ozs. sanders wood, 58 ozs. spirits of wine.

Digest for some time, and then filter. It is better to digest the colouring matters in some of the alcohol, and add the solution of resins. A test of all the varnishes for gilt mouldings and gold lacquers can be easily made by rubbing a small quantity of the varnish upon a piece of bright tin-plate; when this dries the golden lustre will make its appearance. If a warmer shade of gold is required, one more inclined to reddish, a larger quantity of the red colouring substances must be used; but more yellow if a pale gold is desired.

French Sandarac Lac Varnishes..

No. 1. *Ingredients.*—13⅛ ozs. sandarac, 8¾ ozs. elemi, 4⅓ ozs. anime, 1¼ oz. camphor, 33¼ ozs. alcohol 96 per cent., 8¾ ozs. powdered glass.

Preparation.—Dissolve the resins in the alcohol by means of a water bath, adding the glass to facilitate solution.

No. 2. *Ingredients.*—8¾ ozs. sandarac, 4⅓ ozs. colophony, 2 ozs. shellac (refined), 5¼ ozs. Venetian turpentine, 2 1/10 lbs. alcohol 96 per cent.

Preparation.—Same as No. 1.

Universal Varnish, Elastic.

Ingredients.—1 oz. camphor, 2 ozs. colophony, 2 ozs. mastic, 4 ozs. sandarac, 24 ozs. alcohol. Digest.

Universal Varnish, Hard.

Ingredients.—2 ozs. camphor, 2 ozs. colophony, 2 ozs. mastic, 2 ozs. sandarac, 2 ozs. shellac, 24 ozs. alcohol. Digest.

Dammar and Copal Varnish.

Ingredients.—4 ozs. copal, 8 ozs. dammar resin, 1 oz. linseed oil, 10 ozs. oil of turpentine.

Preparation.—Divide the linseed oil into two parts, melt the copal, and dissolve in one portion, melt the dammar resin and dissolve in the other portion, then mix the two,

and add the turpentine to the mixture when cooled enough to prevent the vapour of the oil of turpentine igniting.

Amber Varnish (Volatile).

Ingredients.—3 ozs. amber, ½ oz. Venetian turpentine, 10 ozs. oil of turpentine.

Preparation.—Melt the amber and pour on it when cool enough the oil of turpentine, and then add the Venetian turpentine.

Amber and Copal Varnish (Volatile).

Ingredients.—10 ozs. amber, 30 ozs. copal, 5 ozs. Venetian turpentine, 80 ozs. oil of turpentine.

Preparation.—Same as the last.

Coloured Varnish with Gold Lustre for Frame Mouldings.

These varnishes can be easily prepared by adding to a thick solution of shellac a corresponding quantity of any aniline colouring matter which has been dissolved in spirits of wine, and red, blue, violet, and green tones of colour may be produced; after the aniline varnish has become dry, the articles receive a coat of a colourless varnish.

Gold Lac Varnish.

No. 1. *Ingredients.*—1 oz. gamboge, 2½ ozs. mastic, 2½ ozs. seedlac, $\frac{1}{10}$ oz. saffron, 15 ozs. alcohol.

Preparation.—Digest the saffron in a little alcohol and also the gamboge, dissolve the resin in the remainder; then mix.

No. 2. *Ingredients.*—2 ozs. dragon's blood, 15 ozs. turmeric, 2 ozs. gamboge, 3 ozs. elemi, 2 ozs. seedlac, 5 ozs. sandarac, 5 ozs. spirits of wine.

Preparation.—Same as the last.

English Durable Gold Lac Varnish.

Ingredients.—2¼ lbs. alcohol 96 per cent., 17½ ozs. stick lac (powdered).

Preparation.—Dissolve by heat and filter through blotting-paper.

Gold Lac Varnish (Thompson's Formula).

Ingredients.—4⅕ ozs. gamboge, 4⅕ ozs. stick lac, 4⅕ ozs. annatto, 4⅕ ozs. dragon's blood, 1 oz. saffron, 4⅕ ozs. Venetian turpentine, alcohol q.s.

Preparation.—Powder all the solid ingredients, and put each powder into a separate flask, and pour over each 37 ozs. alcohol 96 per cent. Give two weeks rest to digest, with frequent shakings, and warm turpentine, and to each add the 4⅕ ozs. Venetian turpentine, and filter each varnish through linen; and for use pour all together, or only part of them, according as the lac varnish is desired.

Amber Gold Lac Varnish.

Ingredients.—4⅕ ozs. stick lac, 1 oz. yellow transparent amber, 1½ oz. refined sandarac, 1 oz. mastic in tears, 3⅙ ozs. pure light yellow colophony, 1 oz. dragon's blood, 1 oz. turmeric, 1 oz. gamboge, 4·4 lbs. alcohol 96 per cent.

Preparation.—Powder the solids and digest all in the alcohol by the heat of a sand bath and filter through a cloth filter. Warm the varnish and also the article to be varnished before laying on the varnish.

Mixed Gold Lac Varnish.

Ingredients.—9·8 ozs. refined sandarac, 3½ ozs. pure light coloured copal, 2·1 ozs. stick lac, 4·4 lbs. alcohol 96 per cent., 0·52 oz. turmeric, 1·05 oz. gamboge, 8¾ ozs. alcohol 96 per cent.

Preparation.—Powder the sandarac, copal, and stick lac, and dissolve in the alcohol by heat of water bath, also dis-

solve the colouring substances in the smaller quantity of spirit, and then add.

English Glossy Lac Varnish.

Ingredients.—13⅛ ozs. refined and powdered sandarac, 3·85 ozs. Venetian turpentine, 33¼ ozs. alcohol 96 per cent.

Preparation.—Similar to the last. Put in well-stoppered bottles. This lacquer is very glossy, but does not dry very quickly.

A wrinkle in keeping spirit varnish in stoppered bottles is to soak the stoppers in melted paraffin wax, as then they will not stick.

Ordinary Sandarac Varnish.

Ingredients.—10 parts sandarac, 1 to 2 parts Venetian turpentine, 26 to 30 parts alcohol.

Preparation.—Digest the resin in the alcohol and then add the turpentine.

Gold Varnish (Vernis d'Or).

Ingredients.—½ oz. dragon's blood, 2½ ozs. gamboge, 1½ oz. sanders wood, ½ oz. elemi, 2 ozs. mastic, 1⅕ oz. sandarac, 2 ozs. shellac, 1 oz. Venetian turpentine, 60 ozs. alcohol.

Preparation.—Dissolve each of the resins by itself in the alcohol and separately digest the colouring bodies also in a portion of the spirit, and then mix the two, and filter the mixture. This varnish possesses the property of elasticity in a very high degree on account of its containing mastic, and especially turpentine, and can be used even for leather, oilcloth, &c., as the coating will not crack, even if the article to which it is applied be bent.

Gold Lac Varnish (Held's Formula).

Ingredients.—6 parts shellac, 6 parts aloes, 3 parts amber, 3 parts sandarac, ⅘ part gamboge, ⅖ part dragon's blood, 50 parts oil of turpentine, 6 to 12½ parts linseed oil varnish.

Preparation.—Powder all the ingredients and dissolve them in the oil of turpentine by the heat of a sand bath. The linseed oil is added only if it is desired to make the varnish more durable. After such addition the entire mass is allowed to boil up once more, and finally filtered.

Gold Lac Varnish (Freudenwood's Formula).

Ingredients.—12½ parts gamboge, 12½ parts dragon's blood, 12½ parts aloes, 75 parts oil of turpentine, copal or dammar varnish q.s.

Preparation.—Dissolve all the ingredients in the turpentine and then add sufficient of the copal or dammar varnish to give the desired gold colour.

Dutch Gold Varnish.

Ingredients.—12½ ozs. mastic, 12½ ozs. sandarac, 3 ozs. colophony, 6 ozs. aloes, 20 ozs. oleum spicæ (*i.e.* oil of spike lavender), ⅘ oz. Venetian turpentine.

Preparation.—Powder the first four ingredients and dissolve in the oleum spicæ by placing the vessel in a water bath; then add the Venetian turpentine and filter the mixture.

If this varnish be laid warm and very thin on polished tin, it will produce a beautiful gold colour. Wood, leather, &c., upon which silver leaf has been fastened with the white of an egg, can be beautifully gilt with this varnish.

Elastic Tar Oil Varnish for Finely Polished Goods and Turned Articles.

Ingredients.—6 ozs. sandarac, 2 ozs. American pine resin, 2 ozs. mastic, 1 oz. Venetian turpentine, ⅕ oz. camphor, ⅕ oz. oil of lavender, 24 ozs. varnish oil, 4 ozs. alcohol 90 per cent.

Preparation.—Melt the resin with the turpentine by the heat of a sand bath, dissolve the camphor and essential oil in the spirits of wine, and mix the two solutions.

Gold Varnish without Lac.

Ingredients and Preparation.—15½ ozs. copal, 8 ozs. white boiled turpentine, 2 ozs. camphor, alcohol q.s. Dissolve the above ingredients in sufficient spirit, then prepare a solution of 15½ ozs. of sandarac, 8 ozs. mastic, 4 ozs. annatto, and 2 ozs. aloes in alcohol q.s., and mix the two solutions.

Gold Lac Varnishes with Oil of Turpentine and Oil of Lavender.

No. 1. *Ingredients* (*without linseed oil varnish*).—Boil 33 ozs. of mastic, 33 ozs. of sandarac, and 2 ozs. of turpentine with 50 ozs. oil of lavender over a good fire (be careful against inflammation); then add 15½ ozs. aloes and some resin, and heat the whole until a small feather dropped into the mixture ignites.

No. 2. (*Do., with an addition of linseed oil varnish.*)—

1. *Ingredients and Preparation.*—Dissolve by the heat of a water bath 8 ozs. amber, 15½ ozs. shellac, 8 ozs. sandarac, 15½ ozs. aloes, 2 ozs. gamboge, and 1 oz. dragon's blood in 133 ozs. of oil of turpentine, and add a few drops of strong linseed oil varnish.

2. Reduce to powder 133 parts of amber and 33 parts of stick lac. Dissolve the powder in 133 parts of hot linseed oil varnish and 200 to 266 parts of hot oil of turpentine previously coloured with 33 parts of gamboge, 33 parts of dragon's blood, 33 parts of annatto, and 8 parts of saffron.

3. *Ingredients and Preparation.*—66½ parts of stick lac, 66½ parts of sandarac, 8 parts of dragon's blood, 1 part of gamboge, and 83 parts of powdered glass, and digest the whole in 250 parts of oil of turpentine and 250 parts linseed oil varnish.

Universal Furniture Varnishes.

No. 1. *Ingredients.*—24 ozs. sandarac, 6 ozs. seedlac, 12 ozs. resin, 150 ozs. alcohol, and 18 ozs. Venetian turpentine.

Preparation.—Digest in the spirit, and then add the turpentine.

No. 2. *Ingredients.*—18 ozs. naphtha, 3 ozs. virgin wax. Dissolve and apply the varnish warm, and polish with a woollen rag.

Copal Varnish with Spirit of Sal Ammoniac.

Ingredients and Preparation.—Crush up copal resin, and gradually pour over it spirit of sal ammoniac until the whole is swelled up to a thick transparent mass. Heat this to 100° F., then mix it gradually with alcohol 75 to 80 per cent.; shake thoroughly, and finally add more alcohol to give the mixture the requisite consistency.

Incombustible Varnish for Wood.

Apply a solution of equal parts of alum and isinglass to the place exposed to the flame; this prevents ignition, but not the transmission of heat.

Varnish for Wood not acted upon by Boiling Water.

"Boil in an untinned copper boiler 750 parts of linseed oil. Suspend this in a bag, which must not touch the bottom, 150 parts of minium and 90 parts of pulverised minium. Let the oil boil until it has assumed a dark brown colour; then remove the bag and replace it by one containing 7 to 8 bulbs of garlic. Now melt 500 parts of pulverised amber in 60 parts of linseed oil over a strong fire, add it while boiling to the prepared linseed oil, and let it boil for 2 to 3 minutes longer, stirring it vigorously. Then take it from the fire, allow it to settle, and pour off the clear liquid, and when cold put it in bottles, which should be hermetically closed.

"To use this varnish polish the wood first, and give it the desired colour—for instance, nut brown—by laying on a thin coat of a mixture of lampblack and oil of turpentine.

When the stain is dry apply four coats of the varnish with a fine sponge, allowing one coat to dry before laying on the next."

Parisian Wood Varnish.

This celebrated varnish is prepared by dissolving 1 part of shellac in 3 or 4 of alcohol of 92 per cent. in the water bath, and cautiously adding distilled water until a curdy mass separates, which is collected by filtering through linen. The liquid is filtered through paper, all the alcohol removed by distillation from the water bath, and the resin removed and dried at 212° F. until it ceases to lose weight. It is then dissolved in double its weight of alcohol of at least 96 to 98 per cent., and the solution perfumed with lavender oil.

Furniture Varnish.

Ingredients.—8 parts of white wax, 2 of resin, and ½ of Venetian turpentine.

A New Varnish (German Patent),

which serves as a substitute for linseed oil or oil of turpentine, is prepared thus :—100 parts of resin free from oil of turpentine, 20 of crystallized soda, and 50 of water, are heated together and then intimately mixed with 250 parts of water containing 24 of aqua ammonia. Rub up the colouring bodies in this preparation without the addition of linseed oil or oil of turpentine. They dry easily without a siccative, and can be coated with lacquer. This varnish becomes very hard, resists the action of water and atmospheric influences, and is about one-third cheaper than ordinary varnish.

Colourless Varnish.

"Boil 500 parts of linseed oil with 1000 of water for 2 hours, then add 60 parts silver litharge, 45 of sugar of lead, one onion, and a small piece of pumice-stone, and then heat the mixture for some time longer."

Varnish for Wood naturally Coloured, or Stained.

"Pulverise and dissolve 3 parts of light-coloured shellac, 2 of sandarac, 2 of white resin, and ½ of camphor in 24 of alcohol of 80 per cent. Put first the shellac, sandarac, and camphor in the alcohol, tie up the vessel with a piece of wet bladder, and shake it for half an hour; then add the resin, and let the mixture boil up several times in a suitable vessel. Filter the ready varnish while yet warm through cotton or felt, and to clarify it let it stand in a well-closed bottle for twelve hours. No more varnish than is to be used in two or three days should be prepared at one time, since age impairs its beauty and hardness."

Excellent Glass-like Varnish.

"Dissolve at a moderate heat 4 parts of camphor, 60 parts of sandarac, 15 parts each of Venetian turpentine and oil of turpentine, and 4 parts of white sugar in 400 parts of spirits of wine of 96 per cent., and clarify the solution by allowing it to stand for some time. On using the varnish expose the article to be coated to a gentle heat, and then apply the solution, which, when it becomes dry, will form a beautiful glass-like coat."

Pale Amber Varnish.

Ingredients.—6 parts of fine picked amber (the palest transparent amber being chosen), 2 gallons of hot clarified linseed oil, 4 gallons of turpentine.

Preparation.—Fuse the resin in the gum-pot, and when it is melted, pour in gradually the oil, which should have been heated to a temperature not exceeding 600° F.; stir the mixture vigorously the whole time. Two persons are always required in the making of fat varnishes, one to hold the oil and turpentine to the varnish-maker, relieve him of the vessels, &c., so as to avoid the necessity of him leaving off stirring, which would probably cause the resin to burn. Boil the oil and resin for several hours—the exact time is ascertained by taking a little of

the mixture from time to time and dropping it from the stirring rod on to an iron plate, and then touching the dropped portion with the tip of the rod and drawing it away. If the varnish forms strings or threads, the mixture of oil and resin is boiled long enough. Then remove the gum-pot from the fire, or, if it be fixed, rake out the fire, and pour in gradually, but in a constant flow, the turpentine, stirring the mixture the whole time. This process is the general one in the manufacture of all oil (*i.e.* fat) varnishes. The product in the present instance will be as fine as body copal, will work free and flow well upon any work it is applied to; it becomes very hard, is durable, and is excellent to mix in copal varnishes to give them a hard and durable quality. A long time is always required to bring amber varnish into the condition ready for polishing.

Tough Amber Varnish.

Ingredients.—1½ lb. amber, ¾ lb. Scio turpentine, 3 ozs. transparent white resin, 1½ pint hot linseed oil, oil of turpentine q.s.

Preparation.—Melt the amber (*see* Pale Amber Varnish), add the Scio turpentine (remember the caution about raking the fire out or removing the gum-pot before pouring in this volatile spirit), put in the resin, hot linseed oil, and add enough oil of turpentine to make the mixture of the proper consistency; do not leave off stirring the whole time of mixing. This varnish is very tough.

Body Varnish (for Coachmakers, &c.).

No. 1. *Ingredients.*—4 lbs. finest African copal, 1 gallon clarified oil, 1¾ gallon of oil of turpentine.

Preparation.—Fuse the resin carefully, add the oil, and then boil the mixture for 4½ hours or until quite stringy; then allow it to cool a little, and pour in the oil of turpentine. This varnish dries slowly.

No. 2. *Ingredients.*—4 lbs. pale copal resin, 1 gallon clarified oil, 4 ozs. dried sugar of lead, 1¾ gallon oil of

turpentine, 4 lbs. pale anime resin, 1 gallon linseed oil, 2 ozs. dried white copperas, 1¾ gallon oil of turpentine.

Preparation.—Make the above ingredients into two kinds of varnish separately and mix. Thus fuse the copal, add the oil and sugar of lead, and boil as in last recipe, then add the oil of turpentine. Secondly, prepare the other ingredients into a varnish in a similar manner, and add it to the first while both are hot; then strain the mixed varnishes into cans or the storage cistern.

Brown Hard Spirit Varnish.

No. 1. *Ingredients.*—2 ozs. sandarac, 1 oz. pale seedlac, ½ oz. elemi, 1 pint alcohol, 1 oz. Venice turpentine.

Preparation.—Digest altogether, and then add the Venice turpentine. After the other ingredients are dissolved, filter, or strain.

No. 2. *Ingredients.*—1½ lb. sandarac, 1 lb. shellac, 1 gallon rectified spirit (65 over proof), 1 pint turpentine varnish.

Preparation.—Dissolve the resins in the spirit, then add the turpentine varnish; stir well, and strain. The product is a very fine varnish.

No. 3. *Ingredients.*—¾ lb. seedlac, ¾ lb. yellow resin, 1 gallon rectified spirit.

No. 4. *Ingredients.*—6 ozs. gum-juniper, 6 ozs. shellac, ½ oz. of salts of tartar, 1½ oz. Venice turpentine, 4 pints of alcohol 90 per cent. Mix together.

Cabinetmaker's Varnish.

Ingredients.—2½ lbs. very pale shellac, 3½ ozs. mastic, 2½ or 3 pints alcohol.

Preparation.—Dissolve all the ingredients together in the cold, with frequent stirring. The varnish, which is used for French polishing, is always opaque. A similar varnish made with weaker spirit is used by bookbinders to varnish morocco leather book covers.

Best Pale Carriage Varnish.

This varnish, although intended for the varnishing of the wheels, springs, and carriage parts of coaches, &c., is also used by house painters and decorators, as from its drying quality and strong gloss it suits their general purposes well.

Ingredients.—I. 4 lbs. of second sorted African copal, 5 quarts of clarified oil, 2 ozs. dried copperas, 2 ozs. litharge, $2\frac{3}{4}$ gallons turpentine. II. 4 lbs. second sorted gum anime, 5 quarts of clarified oil, 2 ozs. dried sugar of lead, 2 ozs. litharge, $2\frac{3}{4}$ gallons of turpentine.

Preparation.—Prepare two separate varnishes, strain the first while hot, and then mix both together while still hot. This varnish will dry hard if well boiled—four hours in summer and six in winter. The method of preparation is identical with that of Pale Amber Varnish (*ante*).

Second Carriage Varnish.

This varnish is principally intended for varnishing dark carriages or black japan, and is also used by house painters for dark work. When these resins are poured into the boiling pot, the regular portion of driers put in and well boiled, this varnish will dry hard and firm in 4 hours in winter and 2 in summer.

Ingredients.—4 lbs. second sorted gum anime, $5\frac{1}{2}$ quarts of fine clarified oil, $10\frac{1}{2}$ quarts of turpentine, 2 ozs. litharge, 2 ozs. of dried sugar of lead, 2 ozs. dried copperas.

Preparation.—Boil and mix as before, straining the varnish while hot.

Quick Drying Carriage Varnish.

Ingredients.—4 lbs. fine pale gum anime, 4 quarts clarified oil, 7 quarts of turpentine.

Preparation.—Boil four hours, strain while hot, and put into the above two varnishes, and well mix together; its effect is to cause the whole to dry quicker and firmer, and enable it to take the polish much sooner.

Varnish for Common Work.

Useful for outside work in wood or iron.

Ingredients.—3 lbs. of resin powdered, 2½ pints turpentine, 5 quarts boiled oil.

Preparation.—Pour the turpentine over the resin, in a tin can, give an occasional shake during a couple of days, then add the oil, and allow the mixture to stand in a warm room till clear. Decant the clear portion for use, or reduce it with turpentine to the proper consistency.

Composition Varnish.

The following compound is one which in cheapness, hardness of surface, and its adaptability for protecting and embellishing the surface of walnut and other woods, is a valuable substitute for shellac varnish. The colour may be altered by using for orange a different shade of aniline.

Ingredients.—9 lbs. gum copal, $\frac{9}{10}$ gallon alcohol, 1 gallon benzine, $\frac{6}{10}$ lb. gamboge, $\frac{6}{10}$ oz. orange aniline, $\frac{1}{10}$ gallon alcohol.

Preparation.—Add the copal, benzine, and first quantity of alcohol together, and by a species of churning amalgamate them with varnish separately; dissolve the gamboge and aniline in the second quantity of alcohol, and when thoroughly dissolved filter it with the varnish, and mix well together.

Dammar Varnish.

Ingredients.—1 lb. dammar, ½ lb. sandarac, $\frac{1}{10}$ lb. mastic, 2 lbs. turpentine.

Preparation.—Digest the resin in the turpentine at a moderate temperature, and then add a further quantity of turpentine until of the consistency of syrup.

Dark Varnish for Light Woodwork.

Ingredients and Preparation.—1 lb. shellac, 2 lbs. sandarac, 8 ozs. mastic, 8 ozs. elemi, 4 ozs. dragon's blood, 1 oz.

annatto, 1 lb. white turpentine, 16 lbs. alcohol. Digest and dilute with more alcohol if necessary.

Varnish for Gilt Articles.

Ingredients.—12½ parts gum lac, 12½ parts gamboge, 12½ parts dragon's blood, 12½ parts annatto, 3 parts saffron, alcohol q.s.

Preparation.—Dissolve each resin in 100 parts by measure of absolute alcohol. Make two separate preparations of the dragon's blood and annatto in 100 parts each of alcohol, and a proper proportion of each should be added with the gamboge to the varnish, according to the shade of colour required.

Varnish for Imitation Gilding.

This varnish gives a very good imitation of gilding on brass and bronze articles.

Ingredients.—8 parts gum lac, 2 parts dragon's blood, ½ part turmeric, and 166 parts of alcohol.

Preparation.—Digest altogether.

Method of Application.—Brush the metal with the varnish in all directions by means of a sponge, and then immediately warm over a gentle charcoal fire. The surface at first will appear dull, but will soon resemble the finest gilding. Keep the varnish in well-stoppered bottles.

Varnish for Restoring Whitened German-Gold Frames.

Ingredients.—30 grains gamboge. ½ oz. dragon's blood in coarse powder, 30 grains turmeric powder, 2½ ozs. shellac, and 2½ ozs. sandarac, 1 pint turpentine, 4 ozs. mastic varnish.

Preparation.—Place all the ingredients in a bottle with the turpentine, and keep it in a warm place for a fortnight, shaking at intervals, then filter and add the mastic varnish. Apply this preparation with a brush to metal-coated frames.

Another Varnish for Frames.

Ingredients.—2 ozs. sandarac, 1 oz. mastic in tears, 2 ozs. shellac, ¾ oz. Venice turpentine, 1 pint alcohol 90 per cent., 1 oz. spirit of turpentine.

Preparation.—Put all the ingredients into a suitable vessel, and dissolve by the heat of a sand bath; when well mixed add the spirit of turpentine, and boil for thirty minutes; let it cool, and strain through cotton cloth.

Method of Application.—Apply the varnish to the frame with a brush.

Dead Ground Varnish for Imitation Gilt Frames.

Ingredients.—1 lb. shellac, 1 lb. whiting, alcohol q.s.

Preparation.—Dissolve the shellac in a little alcohol, add the whiting, and then stir in enough alcohol to make 1 gallon of varnish.

Gold Varnishes.

No. 1. *Ingredients and Preparation.*—16 ozs. shellac, 3 ozs. sandarac, 3 ozs. mastic, 1 oz. crocus, 1 oz. gamboge, 144 ozs. alcohol. Digest all in the alcohol, separating by digesting the gamboge, and adding it to the prepared varnish.

No. 2. *Ingredients and Preparation.*—8 ozs. seedlac, 8 ozs. sandarac, 8 ozs. mastic, 2 ozs. gamboge, 1 oz. dragon's blood, 6 ozs. white turpentine, 4 ozs. turmeric, 12 ozs. alcohol. Dissolve and prepare as before, adding the turpentine last.

No. 3. *Ingredients and Preparation.*—1 drachm turmeric, 1 drachm gamboge, 5 ozs. shellac, 5 ozs. sandarac, 7 drachms dragon's blood, 8 ozs. thin mastic varnish, 2 pints oil of turpentine.

Digest with occasional shaking for a fortnight in a warm place, then let it stand to clear, and pour off the clear portion for use.

No. 4. *Ingredients and Preparation.*—1 drachm powdered saffron, ½ drachm of dragon's blood, 1 pint alcohol 90 per

cent., 2 ozs. shellac, 2 drachms Socotrine aloes. Digest the saffron and dragon's blood in the alcohol, then add the shellac and aloes. Dissolve the whole by gentle heat. Yellow painted work varnished with this mixture will appear to almost equal gold.

Furniture Varnishes.

No. 1. *Ingredients.*—6 ozs. white wax, 1 pint oil of turpentine. Dissolve the wax by gentle heat, then stir in the turpentine; use by friction, and rub till a polish is obtained.

No. 2. *Ingredients.*—6 ozs. shellac, 1 quart naphtha. Dissolve. It is ready without the need of filtering.

No. 3. *Ingredients.*—12 ozs. shellac, 3 ozs. copal (or any equivalent of varnish), 1 gallon of naphtha. Dissolve.

No. 4. *Ingredients.*—6 ozs. shellac, 1 oz. seedlac, 1 oz. sandarac, ½ oz. mastic, 1 quart alcohol 90 per cent. Dissolve.

No. 5. *Ingredients.*—8 ozs. shellac, 1 oz. benzoin, 1 quart alcohol 90 per cent.

No. 6. *Ingredients.*—5 ozs. shellac, 3 ozs. seedlac, 3 ozs. sandarac, 3 ozs. copal varnish, 1½ oz. benzoin, 2 quarts alcohol 90 per cent.

To darken the varnish for various coloured woods benzoin and dragon's blood are used, turmeric and other colouring matters are also added, and to make it lighter it is necessary to use bleached lac, though some makers endeavour to give this effect by adding oxalic acid to the ingredients. It, like gum arabic, is insoluble in good spirit or naphtha. For all ordinary purposes the first form is best and least troublesome, while its appearance is equal to any other.

White Furniture Varnish.

Ingredients.—6 ozs. white wax, 1 pint oil of turpentine; dissolve by a gentle heat; or 6 parts white wax, 48 parts

petroleum. Use while the mixture is warm, allow the applied coat to cool, then polish by rubbing with a coarse cloth.

To Varnish Furniture.

In the first place make the work quite clean, then fill up all knots or blemishes with cement of the same colour; have a clean brush free from loose hairs, then dip the brush in the varnish, stroke it along the wire raised across the top of the varnish pot, and give the work a thin and regular coat; soon after that another and another, always taking care not to pass the brush twice in the same place; let it stand to dry in a moderately warm place, that the varnish may not chill. When the work has had about 6 or 7 coats let it get quite hard (which prove by pressing the knuckles on it; if it leaves a mark it is not hard enough), then with the first three fingers of the hand rub the varnish till it chafes, and proceed over that part of the work intended to be polished, in order to take out all the streaks or partial lumps made by the brush, then give it another coat and let it stand a day or two to harden.

Varnish Impervious to Wet.

Ingredients.—100 parts of boiled oil, 6 parts finely divided litharge, 5 parts genuine beeswax. Boil until sufficiently thick and stringy, then pour off the clear.

Japan Varnish.

Ingredients.—6 lbs. Naples asphaltum, 1 lb. dark gum anime, 1½ gallon linseed oil, 1 lb. dark amber with 1 quart linseed oil, 3½ or 4 gallons of turpentine.

Preparation.—Boil the asphaltum, anime, and linseed oil together for two hours. Then boil the amber and second portion of linseed oil, and mix the two together and boil two hours longer till the mass, when cooled, is plastic like putty. Finally, dissolve this plastic mass in the turpentine; the result is a good black japan fit for wood or metal.

Japanese Varnish.

Ingredients.—15 parts copal, 1 part camphor, 60 parts oil of turpentine, 15 parts oil of lavender.

Dissolve the copal and camphor in the oil of turpentine, and then add the oil of lavender.

Black Japanese Varnish.

No. 1. *Ingredients.*—1 part asphaltum, 50 parts boiled oil, 2 parts burnt amber, oil of turpentine q.s.

Preparation.—Dissolve the asphaltum in a portion of the oil, rub up the amber in a little oil, then mix the two compounds, put in the remainder of the oil, stir well, and then thin with oil of turpentine.

No. 2. *Ingredients.*—25 parts shellac, 100 parts wood naphtha. Dissolve.

No. 3. *Ingredients.*—10 parts mastic, 4 parts oil of lavender, ½ part camphor, 26½ parts sandarac, 2 parts Venice turpentine, 3 parts ether, 20 parts alcohol, all by weight. Digest the ingredients until the mixture is a fluid mass. The resulting varnish dries quickly, is colourless, smooth, and shining.

Lac Varnish.

No. 1. *Ingredients.*—8 ozs. seedlac, 1 quart alcohol. Digest and strain.

No. 2. *Ingredients.*—Instead of seedlac use lac bleached by chlorine. Both varnishes are tough, hard, and durable, the last being almost colourless, and is useful for pictures, metal, wood, or leather.

Lac Water Varnish.

Ingredients.—5 ozs. pale shellac, 1 oz. borax, 1 pint water. Put all into a flask or suitable vessel, and heat it nearly to the boiling point, till the shellac is dissolved, then strain. An excellent vehicle for water-colours, inks, &c.;

and a varnish for paints is made then by bleached lac. When dry, it is transparent and waterproof.

Linseed Oil Varnish.

Ingredients.—60 parts linseed oil, 2 parts litharge, 1 part white vitriol, all finely powdered; boil altogether, or else rub up 4 parts borate of manganese with some of the oil, then add linseed oil 3000 parts, and heat to boiling (Walton's process of preparing linseed oil varnish is referred to elsewhere).

Varnish for Mahogany.

No. 1. *Ingredients.*—2 lbs. sorted gum anime, 3 quarts clarified linseed oil, 1 oz. litharge powdered, 1 oz. dried sugar of lead powdered, 5½ quarts oil of turpentine.

Preparation.—Boil the ingredients till the varnish strings well, then let it cool, and thin with the turpentine. Strain.

No. 2. *Ingredients.*—2 ozs. gum sandarac, 1 oz. shellac, ½ oz. gum benjamin, 1 oz. Venice turpentine, 1 pint alcohol 90 per cent., dragon's blood or saffron q.s.

Preparation.—Put all the ingredients into a bottle; stand in a warm place till the gum dissolves, then strain for use.

Brown Hard Spirit Varnish.

No. 1. *Ingredients.*—4 ozs. sandarac, 2 ozs. pale seedlac, 1 oz. elemi, 1 quart alcohol, 2 ozs. Venice turpentine.

Dissolve by agitation and rest, then put the turpentine into the fluid mixture and well mix.

No. 2. *Ingredients.*—3 ozs. sandarac, 2 ozs. shellac, 1 quart alcohol (65 over proof), 1 quart turpentine varnish.

Dissolve, add the turpentine varnish, mix well, and strain. A very fine varnish.

No. 3. *Ingredients.*—1½ oz. seedlac, 1½ oz. yellow resin, 1 quart rectified alcohol.

White Hard Spirit Varnish.

No. 1. *Ingredients.*—5 ozs. gum sandarac, $\frac{1}{16}$ oz. camphor, 1 quart alcohol (65 over proof), 2 ozs. coarsely pounded glass washed and dried, 1 gill very pale turpentine varnish. Proceed as directed for making mastic varnish.

No. 2. *Ingredients.*—2 ozs. mastic picked, $1\frac{1}{2}$ oz. sandarac, $1\frac{1}{2}$ oz. pale clear Venice turpentine, 2 ozs. coarsely ground glass, 1 lb. alcohol. Proceed as last.

No. 3. *Ingredients.*—8 ozs. sandarac, 3 ozs. clear Strasburg turpentine, $1\frac{1}{2}$ pint alcohol. Dissolve.

No. 4. *Ingredients.*—1 oz. mastic (in tears), 4 ozs. sandarac, $\frac{1}{2}$ oz. elemi, 2 ozs. Strasburg or Scio turpentine (genuine), 1 pint alcohol (65 over proof). This varnish is used on metals, and takes a good polish.

Soft Brilliant Spirit Varnish.

Ingredients.—6 ozs. sandarac, 4 ozs. genuine elemi, 1 oz. anime, $\frac{1}{2}$ oz. camphor, 1 quart alcohol. As before.

The above spirit varnishes are chiefly applied to objects of the toilet, as work-boxes, card-cases, &c., but are also suitable to other articles, whether paper, wood, linen, or metal, that require a brilliant and quick drying varnish. They mostly dry almost as soon as applied, and are usually hard enough to polish in twenty-four hours. Spirit varnishes are less durable, and more liable to crack than oil varnishes.

Table Varnish.

No. 1. *Ingredients.*—1 lb. oil of turpentine, 2 ozs. beeswax, 1 drachm colophony. Dissolve by heat.

No. 2. *Ingredients.*—1 lb. dammar resin, 2 lbs. spirit of turpentine, 200 parts camphor. Digest for twenty-four hours, and decant the clear portion, which is fit for immediate use.

Turpentine Varnish.

Ingredients.—10 ozs. clear resin powdered, 1 pint spirit of turpentine.

Dissolve by gentle heat, and then boil for ½ hour; when cool, it is fit for use.

Wainscot Varnish.

Ingredients.—4 lbs. second sorted anime, 1½ gallon clarified oil, 2 ozs. litharge, 2 ozs. dried copperas, 2 ozs. dried sugar of lead, 2¾ gallons turpentine.

Preparation and Use.—Boil all until the mixture strings very strong, then stir, and mix well, and strain. This varnish is principally intended for house-painters, grainers, builders, and japanners; it will dry in two hours in summer, and in 4 in winter.

Oak Varnishes.

No. 1. *Ingredients.*—1¾ lb. clear pale resin, 2 quarts oil of turpentine. Dissolve; if wanted darker, colour with a little fine lampblack.

No. 2.—To the last add 30 ozs. Canada balsam. Oak varnish is synonymous with common turpentine varnish and wainscot varnish.

No. 3. *Ingredients.*—4 pints clear varnish turpentine, 5 pints oil of turpentine. Mix; both are good common varnishes for wood or metal.

Oil Varnishes.

No. 1. *Ingredients.*—3 lbs. resin, 12 quarts drying oil, 2 quarts oil of turpentine. Melt the resin in the oil by heat, and then add the turpentine to thin.

No. 2. *Ingredients.*—3 lbs. resin, 2 lbs. Venice turpentine, 1 gallon pale drying oil. Melt the resin by heat, then add the Venice turpentine and oil, and when cool enough, thin with 1 quart oil of turpentine.

Varnish Finish for Cheap Work.

One coat of filler or stain, followed by one coat of cheap turpentine varnish without rubbing. In this class of work the brilliancy of the gloss and covering qualities of the varnish are principally considered. The cheaper turpentine varnishes have a brilliant gloss, and dry very hard, but the gloss is not permanent, and after drying the gum is very brittle and easily cracked and broken. The gum used is principally common resin.

White Varnish.

No. 1. *Ingredients.*—7½ ozs. tender copal, 1 oz. camphor, 1 quart alcohol 95 per cent.; 2 ozs. mastic, 1 oz. Venice turpentine.

Preparation.—Dissolve the copal and camphor in the alcohol, then add the mastic and Venice turpentine, and when dissolved, strain. This varnish is very white, drying, and capable of being polished when hard. Used for toys.

No. 2. *Ingredients.*—8 ozs. sandarac, 2 ozs. mastic, 4 ozs. Canada balsam, 1 quart alcohol 90 per cent. Dissolve.

No. 3. *Ingredients.*—10 ozs. sandarac, 2 ozs. mastic, ½ oz. anime.

Dissolve in a clean vessel with the aid of a gentle heat. Mix well; when the gums are dissolved, strain through a sieve made of lawn or fine muslin.

White Hard Spirit Varnish.

No. 1. *Ingredients.*—16 ozs. sandarac, 6 ozs. clear turpentine, 3 pints alcohol (65 over proof). Dissolve.

No. 2. *Ingredients.*—4 ozs. mastic, 8 ozs. gum-juniper, 1 oz. turpentine, 2 quarts alcohol 90 per cent. Mix altogether.

Varnish for Woods.

No. 1. *White wood Ingredients.*—1½ lb. bleached shellac, 1¾ gallon alcohol 90 per cent.

Preparation.—Dissolve the shellac in half the alcohol; strain, and then add the remainder of the spirit.

Black Varnish for Wood.

No. 1.—"The ordinary black varnish for woods of different kinds is obtained by boiling together blue Brazil wood, powdered gall apples and alum, in rain or distilled water until it becomes black. This liquid is then filtered and applied to the objects while still warm. The coats are repeated until the wood appears of a fine black colour. It is then coated with the following varnish: a mixture of iron filings, vitriol and vinegar is heated without boiling, and left a few days to settle. If the wood is black enough, yet for the sake of durability it must be coated with a solution of alum and nitric acid, mixed with a little verdigris, then a decoction of gall apples and liquid dyes are used to give it a deep black. A decoction may be made of brown Brazil wood, with alum in rain water, without gall apples. The wood is left standing in it for several days in a moderately warm place, and to it iron filings in strong vinegar are merely added, and both are boiled with the wood over a gentle fire. For this purpose soft pear wood is chosen, which is preferable to all others for black varnishing."

No. 2.—For the fine black ebony varnish, apple, pear, and Brazil wood are recommended in preference for this, especially when these kinds of wood have no projecting veins. They may be succcssfully coated with black varnish, and are then most perfect imitations of the natural ebony. For this varnish, 14 ozs. of gall apples, $3\frac{1}{2}$ ozs. rasped logwood, $1\frac{3}{4}$ oz. of vitriol, and $1\frac{3}{4}$ oz. distilled verdigris are boiled together with water in a well-glazed pot, the decoction filtered while it is still warm, and the wood coated with repeated layers of it. For a second coating a mixture of 3 ozs. of pure iron filings, dissolved in about a pint of strong wine vinegar, is warmed, and when cool, the wood already blackened is coated 2 or 3 times with it, allowing each coat to dry between.

For articles which are to be thoroughly saturated, a mixture of $1\frac{3}{4}$ oz. sal-ammoniac, with a sufficient quantity

of steel filings, is to be placed in a suitable vessel, strong vinegar poured upon it, and left for fourteen days in a gently heated oven. A strong lye is now put into a good pot, to which is added coarsely bruised gall apples and blue Brazil shavings, and exposed for the same time as the former to the gentle heat of the oven, which will then yield a good varnish; the pear wood articles are now laid in the first-named varnish, boiled for a few hours, and left in for 3 days longer; they are then placed in the second varnish, and treated as in the first. If the articles are then not thoroughly saturated, they may be once more placed in the first bath and then in the second. All the above are more properly stains than varnishes, as the wood so treated has no gloss nor protecting glaze, like that furnished by a varnish.

Patent Varnish for Wood and Canvas.

Ingredients.—2¼ lbs. asphaltum, 1 gallon of spirit of turpentine, 1 pint copal varnish, 1 pint boiled linseed oil.

Dissolve the asphaltum in the turpentine by heating the asphaltum and stirring in the fluid when the melted mass is cool enough. Then add the varnish and oil. For a deeper black add a little lampblack.

Parisian Wood Varnish (Grayer's Formula).

Ingredients.—1 part of good shellac dissolve in 3 or 4 parts of alcohol 92 per cent. As the water boils, cautiously add distilled water until a curdy mass separates out, which collect and place between linen; the liquor is filtered through paper, all the alcohol removed by distillation from the water bath, and the resin removed and dried at 100, until it ceases to lose weight; it is then dissolved in twice its weight of alcohol of at least 98 per cent., and the solution perfumed with oil of lavender.

Varnish for Wood Furniture (Niedleg's Formula).

Ingredients.—8 parts white wax, 2 parts colophony, ½ pint Venetian turpentine. Heat gently, with constant stirring; pour the mixture into a glazed stone pot, and add while

still warm 6 parts of rectified oil of turpentine. After standing for 24 hours the mass is a soft buttery substance and is ready for use. The articles to be varnished must be carefully cleansed with soap and water, and dried before applying the varnish. The polish obtained is less brilliant than that obtained by shellac varnish, but it has a peculiar chaste appearance.

Special and Miscellaneous Varnishes.

Varnishes for Bookbinders.

No. 1. *Ingredients.*—4 ozs. elemi, 4 ozs. mastic, 6 ozs. sandarac, 3 ozs. Venetian turpentine, 30 ozs. spirits of wine.

Preparation.—Dissolve the resins in the alcohol in the usual way (*i.e.* by gentle heat and agitation), strain, and then mix the turpentine thoroughly with it.

No. 2. *Ingredients.*—3 ozs. pale sandarac, 20 fluid ozs. alcohol. Dissolve by cold digestion and frequent agitation.

No. 3. *Ingredients.*—Dissolve pale shellac in wood naphtha.

No. 4. *Ingredients.*—6 ozs. mastic in tears, 3 ozs. coarsely-powdered glass (separated from the dust by a sieve), 32 ozs. alcohol 90 per cent., 3 ozs. spirit of turpentine.

Preparation.—Place the ingredients in a sand bath over a fire and let them boil, stirring them well. When thoroughly mixed, introduce the turpentine. Boil for half an hour; remove from the fire, let it cool, and then strain through a cotton cloth.

No. 5. *Ingredients.*—8 ozs. sandarac, 2 ozs. mastic, 8 ozs. shellac, 2 ozs. Venice turpentine, 3 pints alcohol 90 per cent.

Digest in the cold with frequent shaking. Apply lightly on the book with a piece of cotton wool, a small sponge, or a brush.

Colourless Varnish for Bookbinders.

A German authority gives the following directions for making these and several other beautiful varnishes :—

"For 1½ lb. good shellac take 2 ozs. crystallized carbonate of soda, and ¾ gallon water. Put the whole in a clean pot or copper vessel of double the capacity, and under constant stirring bring it to boiling over a slow fire. The shellac will dissolve, and if it is intended to make colourless French varnish, the solution has to be run through a woollen cloth."

"For Brown Bookbinder's Varnish,

or a colourless varnish for maps, photographs, &c. :—

"The solution has to boil for about an hour longer, but only simmering, and then to cool very slowly, without stirring. Better let it stand over-night, and let the fire go out under it. In the morning a wax-like substance will be found on the surface of the solution, and the other impurities of the shellac as a deposit in the bottom of the vessel. The solution is likewise to be run through a woollen cloth, and then filtered."

"To make a Transparent Brown Varnish (Bookbinder's Varnish).

"This filtered solution has to be precipitated with dilute sulphuric acid (1 part acid to 30 parts water), the precipitation collected in a coarse muslin cloth, and washed out with cold clear water until it runs through without taste; then fill a stone or wooden vessel with boiling water, and throw the precipitate in it; it will directly soften down and stick together. This boiling mass has to be kneaded in the hands, doubled up, melted, and drawn out till it assumes a fine silky lustre, then drawn out to the desired thickness in sticks like candy, and it is then ready for solution.

"To make the bookbinder's varnish :—Dissolve ½ pint of the precipitate in 1½ pint alcohol 95 per cent.

"To make the colourless varnish :—Dissolve ½ pint of the precipitate in the same quantity of alcohol. Add 3 drachms of lavender oil to each pint. The colourless varnish will look like whey, but more transparent."

Varnishes for Boots, Shoes, and Leather.

Varnish for Boots.

Ingredients.—10 parts beeswax, 6 parts spermaceti, 66 parts oil of turpentine, 5 parts asphalt varnish, 1 part powdered borax, 5 parts bone black, 2 parts Prussian blue, 1 part nitrobenzol.

Preparation.—Melt the wax, add the borax, and stir till a kind of jelly has formed. In another pan melt the spermaceti, add the asphalt varnish previously mixed with oil of turpentine; stir well, and add the wax. Lastly, add the colour, previously rubbed smooth with a little of the wax; perfume with nitrobenzol. Apply in small quantities, wipe with a cloth, and brush the boots afterwards.

Colourless Varnish for Leather.

Ingredients.—5 ozs. pale shellac, 1 oz. borax, 1 pint water. Digest nearly at the boiling-point until dissolved; then strain.

Harness Varnish.

No. 1. *Ingredients.*—1 oz. isinglass, 1 oz. indigo, 16 ozs. logwood, 16 ozs. best glue, 8 ozs. soft soap, 2 quarts vinegar. Mix by heat, and strain.

No. 2. *Ingredients.*—$\frac{1}{2}$ gallon alcohol, $\frac{3}{4}$ lb. white turpentine, $\frac{3}{4}$ lb. shellac, $\frac{1}{2}$ gallon Venice turpentine, olive oil q.s. Digest the resins in the fluids, and, when dissolved, add a little olive oil, and colour, if desired, with lampblack.

Varnish Cement for Fastening Leather to Metal.

Ingredients and Preparation.—Dissolve 1 oz. of gum-arabic in water, and an equal weight of isinglass in brandy.

Flexible Varnish for Leather.

No. 1. *Ingredients.*—2 ozs. burnt umber, 1 oz. asphaltum, 1 quart linseed oil.

Preparation.—Dissolve the asphaltum with heat in a little of the oil; then add the umber ground in the oil. Mix; add the rest of the oil. Boil, and when cool, then mix with turpentine.

No. 2. *Ingredients and Preparation.*—Immerse a sheet of paper in a solution of gelatine; then dry, and soak the paper in a solution of tannic acid. The gelatine will be converted into a kind of varnish.

Black Leather Varnish.

No. 1. *Ingredients.*—Durable leather varnish is composed of boiled linseed oil, in which a drier, such as litharge, has been boiled. It is coloured with lampblack. This varnish is used for making enamelled leather (*see* Japans).

No. 2. *Ingredients.*—12 ozs. shellac, 5 ozs. white turpentine, 2 ozs. sandarac, 1 oz. lampblack, 4 ozs. spirit of turpentine, 96 ozs. alcohol.

Patent Leather.

Patent leather cannot be prepared on a small scale, and all attempts of the amateur will end in failure.

Ingredients.—The first coat varnish is prepared as follows: —Prussian blue (containing a trace of alumina) 5 ozs., drying oil 1 gallon. Boil to the consistency of single size, and, when cold, grind with a little vegetable black. The second coat is like the first, except that pure Prussian blue is used. The third coat has the oil boiled longer, and more of the blue and lampblack is added. The last coat is the same, except that it must contain $\frac{1}{2}$ lb. more Prussian blue, and $\frac{1}{4}$ lb. of pure vegetable black per gallon.

Varnish for Boots and Shoes.

No. 1. *Ingredients and Preparation.*—Boil together 1 pint linseed oil, $\frac{1}{2}$ lb. mutton suet, $\frac{1}{2}$ lb. beeswax, and a small piece of resin, and when the mixture becomes milk-warm, apply it with a hair brush. After the application the articles will become waterproof.

No. 2. *Ingredients.*—Common tar may be brushed over the soles of boots and shoes; they are then placed near the fire, so that the tar may be absorbed. When this has taken place a second or third application may be given with advantage. The above application is not suitable to the upper leathers.

No. 3.—India-rubber varnish will be found very useful for animating the upper leathers of boots and shoes, and keeps them watertight.

Elastic and Clean Varnish for the Leather of Ladies' Shoes.

Ingredients and Preparation.—3 lbs. of rain-water are placed in a pot over the fire, and when well boiling there are added 4 ozs. white pulverised wax, 1 oz. clear transparent glue in small pieces, 2 ozs. pulverised gum Senegal, 2 ozs. white soap scraped fine, 2 ozs. brown pulverised sugar. The ingredients are placed in one by one, being then stirred up. It is well to take the pot from the fire every time a substance is added, to prevent boiling over. When all is added the pot is removed from the fire; when sufficiently cooled 3 ozs. alcohol are added, and finally 3 ozs. of fine Frankfort black, well incorporated by continued stirring. This varnish is put on the leather with a brush, and is very valuable for boots and shoes, as it can be afterwards polished with a large brush, like ordinary shoe-blacking. It shows a high polish, and does not soil the clothing.

Varnish for the Edges of Shoes.

Ingredients.—2 ozs. shellac, 1 oz. resin, $\frac{1}{4}$ or $\frac{1}{8}$ oz. lampblack, $\frac{1}{2}$ oz. turpentine, 8 fluid ozs. alcohol. Mix by gentle heat.

Black Varnish for Shoe and Harness Edges.

Ingredients.—1$\frac{1}{2}$ oz. shellac, 1 oz. resin, $\frac{1}{2}$ oz. pure turpentine, $\frac{1}{8}$ oz. lampblack, $\frac{1}{2}$ pint alcohol 98 per cent.

Dissolve. This varnish may also be applied to cloth or wood when a gloss is desired after painting.

Miscellaneous Varnishes.

Canada Balsam Varnish.

(To render ground stain transparent.)

Ingredients.—4 ozs. Canada balsam, 12 ozs. mastic, 12 ozs. benzole.

Preparation.—Dissolve the mastic in the spirit, and then, having baked the balsam in an oven until quite brittle, when cooled, dissolve it in the mixture of benzole and mastic.

Changing Varnish, to imitate Gold or Silver.

Ingredients.—5 ozs. gamboge, 4 ozs. spirit of turpentine, $1\frac{1}{4}$ oz. annatto, 10 ozs. spirit of turpentine, 5 ozs. dragon's blood in 40 ozs. spirit of turpentine.

Preparation.—Make three separate mixtures and keep in separate vessels; expose each vessel to sunlight, and keep in a warm place for two or three weeks.

Method of Using.—Mix together such quantities of each solution as will produce the colour desired.

Crystal Varnishes.

No. 1. *Ingredients and Preparation.*—Equal parts of genuine pale Canada balsam and rectified oil of turpentine; mix, place the bottle in warm water, agitate well, set it aside in a moderately warm place, and in a week pour off the clear. This varnish is used for maps, prints, drawings, and other articles of paper, and also to prepare tracing paper and to transfer engravings.

No. 2. *Ingredients.*—3 ozs. mastic, 1 pint alcohol. Dissolve. This is used to fix pencil drawings.

Varnish for Ink Drawings.

Put a drop of acetic acid into the ink, and when the drawing is dry varnish with mastic varnish.

Varnish for Engraving on Copper.

No. 1. *Ingredients and Preparation.*—1 oz. yellow wax, 1 oz. mastic, ½ oz. asphaltum. Melt the whole by heat, pour the mixture into water, and form into balls for use.

No. 2.—A softer varnish for engravers is made with 1 part tallow, 2 parts yellow wax. Or

No. 3.—2 ozs. wax, 1 drachm turpentine, 1 drachm olive oil, either melted by gentle heat.

Engineer's Stopping-out Varnish.

Take lampblack and turpentine to make a paste.

Etching Varnish (Lawrence's Formula).

No. 1. *Ingredients.*—2 ozs. white wax, ½ oz. black pitch, ½ oz. Burgundy pitch, 2 ozs. asphaltum in powder.

Preparation.—Melt the wax and pitches together, and add the asphaltum by degrees, and boil till a drop taken out on a plate will break when cold by being bent double two or three times between the fingers. It must then be poured into warm water, and made into small balls for use.

Callot's Florentine Hard Varnish.

No. 2. *Ingredients and Preparation.*—Melt together equal parts of linseed oil and mastic by heat.

Callot's Soft Varnish.

No. 3. *Ingredients and Preparation.*—4 ozs. linseed oil, ½ oz. gum benzoin, ½ oz. white wax. Boil till reduced to two-thirds of its bulk.

To Varnish Engravings and Drawings.

Size with weak isinglass size (1 oz. to the pint of water); give 2 coats, then varnish with mastic varnish.

Flanders or Flemish Varnish.

Dissolve mastic in tears in alcohol, using sufficient spirit to cover the mastic and a quarter part more.

Italian Varnish.

No. 1. *Ingredients and Preparation.*—Boil Scio turpentine till brittle; powder and dissolve in oil of turpentine.

No. 2. *Ingredients.*—6 ozs. clean white resin, 6 ozs. Canada balsam, 1 quart oil of turpentine. Dissolve. Use for prints, &c.

Varnish for Lithographs and Drawings.

Ingredients.—20 parts dextrine, 5 parts alcohol, 20 parts water. Digest; give a couple of coats of starch paste, then varnish.

Lithographic Varnish.

Ingredients and Preparation.—"Put 2 quarts of the best linseed oil into a saucepan large enough to hold 1 gallon. The lid should have a long handle, so that it may be put on the vessel with safety while the contents are burning. Set it on a clear fire until white fumes arise. Apply a lighted paper occasionally, until these fumes catch fire and burn. It must now be watched carefully, so that the flame shall not become unmanageable. If the flame goes down a little it may be increased by stirring with an iron rod. If it shows a tendency to rise too high, it may be removed from the fire, when it will continue to burn. If it rises too high and threatens to become dangerous, the lid must be put on, when the flame, being deprived of the access of air, will be extinguished. If the flame has been very high, the lid should be kept on long enough to allow the whole of the oil to cool down a little. The oil is burned until it becomes one-sixth less. A thick slice of bread is now put in and moved about with a fork until it is browned. It is then allowed to burn a little more, it being set on the fire again

to revive the flame if the latter has become dull. A second slice is now put in and browned as before. This process is used to free the oil from its more greasy particles. One-fourth of the oil may now be taken away. If on becoming cold it is of a syrupy nature, it may be set aside for thin varnish. The rest having been burned again for a short time, one-third part is taken away. This is medium varnish. The remainder is again burned, and one-half set aside for strong varnish. The fourth portion is again burned, and when cold should be thick and ropy. It is necessary to take every precaution to guard against accident."

Varnishes for Maps, Prints, &c.

No. 1. *Ingredients.*—5 ozs. mastic, 2 ozs. sandarac, 1 oz. camphor, 16 ozs. alcohol 93 per cent.

No. 2. *Ingredients.*—2 ozs. balsam of Canada, 4 ozs. spirit of turpentine. First size the paper with a solution of isinglass, and dry before applying the varnish.

No. 3. *Ingredients and Use.*—Use Canada balsam or dammar varnish. The principal trouble will be in removing the old wax. The paper must be perfectly dry.

No. 4.—Mounted maps are sized with thin glue and varnished with mastic.

No. 5. *Ingredients.*—6 parts mastic, 3 parts sandarac, 3 parts turpentine, 32 parts alcohol.

Preparation.—Put the resins with the alcohol in a copper vessel—tinned inside—place the vessel in a water bath, and stir until the resins are dissolved—an operation requiring several hours; then add the turpentine and stir for another hour, after which strain the varnish and set it aside for use.

To varnish maps and paper diagrams, the first and most essential operation is the proper sizing of the paper, as if this be imperfectly done, almost any kind of varnish will penetrate the paper so as to make oil spots. Glue water of the proper consistency is the best protective against the absorption of the varnish. It should be of the right strength, however. If, after being dried, it cracks in bend-

ing a corner of the paper, it was not diluted enough. When dry, the map is varnished with a solution of mastic, sandarac, or some other colourless resin in turpentine or alcohol, or a mixture of both; experience shows the best consistency in order to lay it on evenly with a brush. In cold weather it requires more of the solvent.

Mastic Varnishes.

Picture Varnish, Turpentine Varnish.

No. 1. A tone varnish. *Ingredients.*—5 ozs. very pale and picked mastic, 2½ ozs. glass pounded as small as barley and well washed and dried, 1 pint rectified turpentine.

Preparation.—Put all the ingredients into a stone or tin bottle, bung down securely, and keep rolling it backwards and forwards pretty smartly on a counter or any other solid place for at least 4 hours, when, if the gum is all dissolved, the varnish may be decanted, strained through muslin into another bottle, and allowed to settle. This varnish should be kept for 6 or 9 months before use, as it thereby gets both tougher and cleaner.

Varnish for Paintings.

Ingredients.—6 ozs. mastic, ½ oz. pure turpentine, 2 drachms camphor, 19 ozs. spirit of turpentine.

Preparation.—Add the camphor to the turpentine first of all, dissolve by the heat of a water bath, and then add the mastic and spirit of turpentine at the end of the operation. Filter through a cotton cloth.

Paper Varnish.

Ingredients.—1 oz. Canada balsam, 2 ozs. oil of turpentine; or else, 4 ozs. Canada balsam and 8 ozs. camphine. Previously size the paper with gelatine.

Picture Varnish.

Several varnishes are called by this name. Pale copal or mastic varnish is generally used for oil paintings, and crystal white hard spirit or mastic varnish for water-colour drawings on paper.

Print Varnish

is a compound of benzole and almond oil. This varnish does not give the slightest glaze to photographs or plain paper.

Varnish for Prints.

No. 1. *Process.*—A piece of plate glass is heated, and while yet warm a little wax rubbed over it; water is then poured over the plate and the moistened picture laid thereon and pressed closely down by means of a piece of filtering paper. When dry the picture is removed, and will be found to possess a surface of great brilliancy, which is not acquired by the process of mounting.

No. 2. *Ingredients.*—20 ozs. sandarac, 8 ozs. mastic, 1 part camphor, 48 ozs. alcohol; previously size with 1 or 2 coats of gelatine solution.

De Sylvestre's Dextrine.

Ingredients.—10 parts dextrine, 30 parts water, 5 parts of alcohol.

Dissolve the dextrine in the water and then add the spirit.

Transferring Varnish.

Ingredients.—6½ ozs. mastic in tears, 12½ ozs. resin, 25 ozs. pale Venice turpentine, 25 ozs. sandarac, 5 pints alcohol.

Preparation.—Dissolve in warm place with frequent agitation and strain through muslin.

Transfer Varnish for Engravings, Diaphrams, &c.

No. 1. Pale Canada balsam and rectified oil of turpentine, equal parts. (This is also called crystal varnish.)

No. 2. *Ingredients.*—4 ozs. mastic, 4 ozs. sandarac, 1½ pint rectified spirit, ½ pint Canada balsam.

Dissolve the resins in the spirit and then mix the balsam with it by gentle heat and shakings.

To Varnish Water-Colour Drawings.

No. 1.—Boil some parchment in clean water until it becomes a clear size, strain, and keep for use; give the work 2 coats, letting the first dry before putting on the second. Do the varnishing quickly and lightly. When dry apply a varnish made by dissolving 1 oz. Canada balsam in 2 ozs. oil of turpentine.

No. 2.—Size the drawing thoroughly and carefully with a solution of isinglass; when perfectly dry brush over with a varnish made of 1 part of Canada balsam in 2 parts of camphine, warm gradually, and shake well together till dissolved. This varnish is also called Canada varnish, and is used for varnishing drawings, maps, prints, &c.

No. 3.—A good way to varnish water-colours without disturbing the colours is to float over the surface of the drawing a sufficient quantity of colourless fluid ox-gall, and when thoroughly dry, with a coat of clear copal varnish thinned with the gall. This preparation of ox-gall is invaluable to all water-colour artists, as it sets the colour beautifully.

French Sandarac Varnish for Metals.

Ingredients.—8¾ ozs. sandarac, 8¾ ozs. mastic, 4⅕ ozs. Venice turpentine, 7 ozs. powdered glass, 2⅕ lbs. alcohol of 96 per cent.

Prepare by dissolving the resins in the alcohol by the heat of a water bath and adding the turpentine when the resins are dissolved. The glass is added to prevent caking of the resins so as to present a greater surface to the solvent

action of the alcohol. Strain through a fine linen sieve and then through a plug of cotton-wool in the neck of a funnel.

Dutch Varnish for Metals.

Ingredients.—8¾ ozs. refined sandarac, 8¾ ozs. mastic in grains, 4⅓ ozs. of anime, 3 3/10 lbs. of alcohol 96 per cent.

Preparation.—Same as the above.

Lac Varnish for Water-Colour Pictures.

Ingredients.—7 ozs. refined sandarac (powdered), 1 oz. mastic (powdered), 17½ ozs. alcohol 96 per cent., 2 1/10 ozs. Venetian turpentine.

Preparation.—Same as last.

Very Transparent Mastic Varnish for Oil Paintings.

Ingredients.—12½ ozs. finest mastic, 1¾ oz. Venetian turpentine, ½ oz. camphor, 8 ozs. rectified French oil of turpentine, 2⅕ lbs. alcohol 96 per cent.

Preparation.—Same as the last.

Spanish Mastic Varnishes.

No. 1. *Ingredients.*—4 to 5 ozs. mastic, 5 to 6 ozs. sandarac, 26 to 30 ozs. spirits of wine, ½ to ¾ oz. Venetian turpentine.

No. 2. *Ingredients.*—5 to 6 ozs. mastic, 10 to 12 ozs. sandarac, 26 to 30 ozs. spirits of wine, ¼ to ½ oz. Venetian turpentine.

Preparation.—Similar to above.

Insoluble Varnishes for Copper-plates and Maps.

When copper-plates, engravings, maps, and paper in general are to be coated with a thin layer impervious to water, but nevertheless elastic, the following process is

used: Fine gilder's glue is dissolved in water in the proportion of $1\frac{3}{4}$ oz. of glue to 2 pints of water; the warm solution is applied to the surface of the paper, and this is allowed to dry thoroughly. After the paper has become dry, it is laid in a solution of acetate of alumina and allowed to remain there for one hour; the paper is then washed off, dried, and smoothed. A coating of alumina and glue has thus been formed upon the paper—a process which is called "awing." Such a paper can be washed with a damp sponge without suffering injury.

Mastic Varnish for Articles of Pasteboard (Held's Formula).

Ingredients.—$12\frac{1}{2}$ ozs. mastic in tears (powdered), $6\frac{3}{10}$ ozs. refined sandarac (powdered), 7 ozs. powdered glass, $4\frac{4}{10}$ lbs. alcohol 96 per cent., 7 ozs. Venetian turpentine.

Preparation.—Dissolve the resins mixed with the glass in the alcohol, then liquefy the Venetian turpentine, and add that to the spirit with frequent shakings, and then filter.

Parchment Fluid

for fixing crayon and charcoal drawings, is made by soaking gutta-percha in ether. Pictures, maps, &c., can also be coated with this varnish.

Photographic Varnishes.

Light Varnish for Lacquering Negatives.

Ingredients.—1 oz. dammar resin, $\frac{1}{2}$ oz. mastic, $\frac{1}{4}$ oz. sandarac, 10 ozs. chloroform, 10 ozs. varnish oil.

Preparation.—Pulverise the resin, pour the chloroform over it, then add the varnish oil, and digest the whole in a sand bath until all are dissolved. Filter the varnish through clean cotton, and keep it in well-closed bottles. It dries very easily.

Varnish for Negatives.

Ingredients.—4 ozs. sandarac, 20 ozs. spirits of wine, ½ oz. chloroform, 3 ozs. oil of lavender; the filtered solution is spread out by pouring it over the glass-plate, and dried by applying heat. The coating is perfectly colourless, and negatives coated with this varnish do not crack, even if they are stored away for a long time.

Retouching Varnishes for Negatives (Monkhouse's Formula).

Shellac is placed for 24 hours in a saturated solution of carbonate of ammonia in water, the solution is then poured off and replaced by an equal quantity of pure water, and the fluid is boiled under constant stirring until a complete dissolution has taken place. The proportion between shellac and water should be as 1 to 8. This is poured twice in succession over the negative, which must be thoroughly dry. Retouching can be done more quickly and finer upon this coating than upon any other.

Retouching Varnish for Photographs.

Ingredients.—·035 oz. shellac, 21 ozs. sandarac, 21 ozs. mastic, 2·7 fl. dr. ether. Dissolve and add 2·7 fl. dr. of pure benzole.

Photographers require for their work a lacquer which must possess peculiar properties; on the one hand, it must be entirely colourless, must adhere tightly to the glass, and be as hard as possible; and on the other, it must be so constituted as to allow of the plate being retouched with a lead pencil. The most important property required of these varnishes is hardness, as only in cases where the glass negative is coated with a hard varnish is it possible to take many copies without injury to the plate; and finally, it should be mentioned that these varnishes must also possess a certain degree of elasticity, and must not crack when the varnished plate is put away, as this would be equivalent to a complete spoiling of the photographic negative. As will

be seen, quite contradictory properties—hardness and elasticity—are demanded for such varnish, and it is scarcely possible to give equal satisfaction with both of them.

Dead Surface Varnish.

Varnishes that have a dead surface on drying, capable of substitution for ground glass—as for glass stereographs—and of use in retouching negatives, may be made by mixing solutions of resin with liquids in which they are insoluble. A solution of sandarac, resin, or ether, when mixed with one-fourth as much benzole, affords an excellent imitation of ground glass; one of dammar resin in benzole, when mixed with ether, also forms a good dead surface; water instead of the ether renders it all the same—semi-opaque. A mixture of benzole with common negative-varnish frequently, but not always, gives a beautiful dead surface. In all cases, a great deal depends on the purity of the ingredients. It is recommended to dissolve from 3 to 5 parts of sandarac in 48 parts of ether, and to add 24 parts of benzole, or as much as may be necessary to produce the desired result. The following gives a perfectly colourless varnish of this kind:—

Ether 56 grains, benzole 24 grains, sandarac 4 grains, Canada balsam 1 grain. Dissolve the resins in the ether, and then add the benzole to the mixture.

Ground Glass Varnish.

Ingredients.—90 grains sandarac, 20 grains mastic, 2 ozs. ether, ½ to 1½ oz. benzole; the proportion of the benzole added determines the nature of the matt obtained.

Hare's Colourless Varnish for Photographs.

Dissolve shellac by the aid of heat in 8 parts of water and 1 part of pearl ash. Precipitate by chlorine, and dissolve in alcohol.

Negative Varnishes.

No. 1. *Ingredients.*—4 ozs. sandarac, 20 ozs. alcohol, 3 ozs. oil of lavender, 5 drachms chloroform.

No. 2. *Ingredients.*—8 ozs. white hard varnish, 5 ozs. methylated varnish. This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon, and easily cleared off. Very suitable for enlarging negatives that are not to be returned.

No. 3. *Ingredients.*—9 ozs. sandarac, $3\frac{1}{2}$ ozs. turpentine, 1 oz. oil of lavender, 50 ozs. alcohol. This may be rubbed down with powdered resin, and gives a splendid surface for retouching.

No. 4. *Ingredients.*—2 ozs. sandarac, 1 to $1\frac{1}{2}$ oz. seed-lac, 3 drachms castor oil, $1\frac{1}{2}$ drachm oil of lavender, 18 fl. ozs. alcohol.

No. 5. *Ingredients.*—$1\frac{1}{2}$ oz. best orange shellac, 1 pint methylated spirit.

Preparation.—Keep in a warm place until dissolved, then add a large teaspoonful of whiting or prepared chalk; set aside to clear, and then decant. This is especially recommended for gelatine negatives.

No. 6. *Ingredients.*—3 ozs. bleached lac, 1 oz. mastic, $\frac{1}{10}$ oz. Venetian turpentine, 25 ozs. rectified alcohol. The negative must be warmed.

No. 7. *Ingredients.*—3 ozs. bleached shellac, 24 ozs. alcohol, 1 oz. sandarac, $1\frac{1}{2}$ oz. oil of lavender.

Preparation.—Dissolve the shellac in the alcohol; when dissolved, filter, then add the sandarac and essential oil; filter again and bottle for use.

Matt Varnish.

No. 1. *Ingredients.*—40 grains mastic, 160 grains sandarac, 4 ozs. methylated spirit, $1\frac{1}{2}$ oz. benzol.

Black Matt Varnish.

No. 2. *Ingredients.*—50 grains mastic, 200 grains sandarac, 1½ oz. methylated spirit, ½ oz. benzol.

No. 3. *Ingredients.*—18 parts sandarac, 4 parts mastic, 200 parts ether, 80 to 100 parts benzol.

Retouching Varnish.

No. 1. *Ingredients.*—1 oz. sandarac, 80 grains castor oil, 6 ozs. alcohol.

First dissolve the sandarac in the spirit, then add the castor oil (to prevent the varnish being brittle).

No. 2. *Ingredients.*—150 parts alcohol, 25 parts sandarac, 2½ parts camphor, 5 parts castor oil, 2½ parts Venetian turpentine.

No. 3. *Ingredients.*—"A good retouching varnish is a boon to all retouchers, and those who are unfortunate enough to be plagued by too thin films, will gladly hail a formula which promises this desideratum. The following is a varnish recommended for the purpose by a good authority:—60 parts alcohol (sp. gr. 0·830), 10 parts sandarac, 2 parts camphor, 4 parts Venetian turpentine, 3 parts oil of lavender. This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil; the varnished film is in best condition when a day old."

Varnishes for Violins.

Spirit Varnishes for Violins and Other Musical Instruments.

Ingredients.—12 ozs. sandarac, 6 ozs. shellac, 6 ozs. mastic, 3 ozs. elemi, 15 ozs. highly rectified spirits of wine, 6 ozs. Venetian turpentine.

Preparation.—Boil up all the ingredients excepting the turpentine several times; then, when cool, add the Venetian turpentine.

Violin Varnish.

No. 1.—The famous Italian violin makers used, it is said, the following sort of varnish on their instruments:—Rectified alcohol, ½ gallon, 6 ozs. gum sandarac, 3 ozs. gum mastic, and ½ pint turpentine varnish. The above ingredients are put into a tin can by the stove, and frequently shaken until the whole is well dissolved. It is finally strained and kept for use. If upon application it is seen to be too thick, thin with an addition of more turpentine varnish. The wood should be stained before applying the varnish. For a red stain use camwood, logwood, or aniline.

Red Varnish for Violins.

No. 2. *Ingredients.*—6 ozs. sandarac, 3 ozs. shellac, 3 ozs. mastic, 1½ oz. elemi, 75 ozs. alcohol 95 per cent., cochineal, or dragon's blood, q.s., 3 ozs. Venetian turpentine.

Preparation.—Dissolve sufficient cochineal, or dragon's blood, in the alcohol to produce the tone of red required, then digest all the above resins in the spirit by means of a water bath, and add the Venice turpentine.

No. 3. *Ingredients.*—4 ozs. copal resin in coarse powder, 4 ozs. glass coarsely pounded, ½ oz. camphor 1 pint alcohol 64 over proof.

Preparation.—Heat in a water bath with frequent stirring so that the bubbles may be counted as they rise until the solution is complete, and when cold decant the clear portion.

No. 4.—"The true Cremona varnish is of unknown formula; its preparation is a lost art.

"Amber fused, 2 ozs., oil of turpentine 5 ozs., drying linseed oil 5 ozs.

"The following is for a spirit varnish:—Mastic 1 drachm, sandarac 1 drachm, lac 6½ drachms, alcohol 5 fluid ozs.

To tinge with yellow, annatto, aloes, gamboge, or turmeric may be used; for red, dragon's blood, or red sanders wood. By mixing the above, intermediate shades may be obtained. The formula is only half the art; much depends on the application, treatment between coats, &c. It should be done by an expert."

No. 5.—"The recipe for violin varnish as used by German violin makers is:—4 parts sandarac resin, 2 parts shellac, 1 part mastic, 2 parts benzoes (benzoin?) resin, 2 parts Venetian turpentine, and 32 parts of alcohol. The solid ingredients are first dissolved in the alcohol and the Venetian turpentine added afterwards, and finally the whole carefully filtered to get rid of all dust. Brushes to be kept scrupulously clean. For staining, campeachy wood is used, mixed with about ¾ yellow dye wood, and boiled for two hours in five times its weight of water in a copper or earthen vessel. No iron should come in contact with it, as this makes the solution black. The violins are coloured with this solution when well cleared, and afterwards varnished."

The quality of the tone of a violin depends very much on the nature of the varnish employed, for reasons every musician will understand, viz., the varnish renders the wood more compact and homogeneous, as it brings the fibres into closer contact. The following recipe for *ascertaining the tone or musical note given off by a piece of wood*, will be serviceable to all who wish to experiment in varnishing their instruments:—

"Dissolve by heat 2 ozs. amber in oil of turpentine, 5 ozs., and drying linseed oil 5 ozs. Colour with dragon's blood or extract alkanet root. The tone given by a piece of wood depends upon its size, thickness, &c. Cut square pieces of equal size and thickness of a known wood, and of the wood to be tried. Press the centre of the plate of wood with the thumb, and bow it near one of the corners. This will give the lowest note such a plate can produce, or the normal tone. The higher the pitch, the better the wood.

"Find the tone of a piece of wood by direct comparison

with similar notes on the piano or any standard instrument. A violin in tone at the proper pitch by a tuning-fork is very convenient."

Varnishes for Miscellaneous Purposes.

Varnish for Gilders.

Ingredients.—1¼ oz. elemi, 1½ oz. mastic, 3 ozs. sandarac, 75 ozs. spirits of wine. Dissolve and strain.

Varnishes for Making Rubber Balloons Impermeable.

"These varnishes are prepared of farinaceous substances, gum tragacanth, or other vegetable gum, dextrine, sugar, albumen, collodion prepared without ether, glue (isinglass, common glue, or lip-glue). These are freed from all undissolved substances by straining them through a hair sieve, and must be entirely clear. The main point in respect to these varnishes is that they should form an impermeable but as thin a layer as possible, upon the balloon or other article to which they may be applied. The balloon is coated with the varnish as soon as it is filled with gas, and for the purpose of closing the pores of the rubber and covering them with a film through which the hydrogen gas cannot penetrate. Water or diluted spirits of wine is used as a solvent for the substances. Fatty substances must not be employed, as they might exert a decomposing effect upon the rubber. Only the collodion is mixed with a very small quantity of castor-oil, so that the film produced upon the balloon may not be too brittle."

No. 1. *Ingredients.*—32 parts gum, 8 parts sugar, 60 parts water. The proportions may be changed at will according as it is desired to have the varnish more or less pliant. The varnish becomes harder if less sugar is used.

No. 2. *Ingredients.*—28 parts dextrine, 12 parts best glue, 60 parts water. These proportions may also vary.

The more dextrine the harder becomes the varnish. For a very pliant but not very durable varnish, glue alone may be used, by taking 60 to 70 parts of water for each 100 parts of varnish to be prepared. In regard to the collodion varnish, this must contain from 5 to 6 per cent. of castor-oil, but the collodion must be prepared without ether.

No. 3. *Ingredients.*—24½ ozs. white wine, 7 ozs. gum tragacanth, 5½ ozs. treacle, 10½ ozs. alcohol.

Preparation.—Mix the ingredients together (except the alcohol), boil these for half an hour, then allow to cool off and mix the alcohol therewith; then filter and put into bottles immediately.

The following varnishes are for balloons made of silk and other fabrics :—

No. 1. *Ingredients.*—Good linseed oil, if allowed a sufficient time to dry and harden, forms an excellent varnish for balloon cases.

No. 2. *Ingredients.*—1 lb. india-rubber cut up small, 6 lbs. oil of turpentine, 1 gallon boiled drying oil.

Preparation.—Digest the india-rubber in the turpentine in a warm place for a week, frequently shaking the vessel during the whole time, then place it in a water bath and gradually heat it until the solution be completed. Next add the oil, previously made warm, gently simmer for five minutes, stirring all the while, after which closely cover it over, and when cool strain it through flannel.

No. 3. *Ingredients.*—1 lb. birdlime, 3 pints boiled linseed oil, turpentine q.s.

Preparation.—Boil the birdlime with 1 pint of the oil in an iron pot over a slow fire for about half an hour, or until the former ceases to crackle, then add the rest of the oil, previously heated, and again boil for 1 hour, stirring well all the time, being careful that it does not boil over, as it is very liable to do so. When it has boiled sufficiently may be known by its admitting being drawn into threads between two knives; as soon as this occurs remove the pot from the fire, and, when cooled a little, add a sufficient quantity of spirit of turpentine, warm, to reduce

it to a proper consistency, and work it well up. These varnishes are better applied lukewarm to the silk, previously stretched out tight. In about 24 hours they will dry.

Aniline Varnishes.

No. 1.—These varnishes are very useful, as even when in a very thin film the colour is intense. Use alcohol to dissolve the shellac or sandarac. Prepare also an alcoholic solution of the aniline colours; add this to the varnish; warm the object slightly.

No. 2.—Collodion can also be used to carry the aniline colours, and gives a very thin coating.

Aniline Black Varnish.

No. 3. *Ingredients.*—6¾ drachms (avoirdupois) aniline blue, 1¾ drachm fuchsine, 4½ drachms naphthalin yellow, 1 quart alcohol.

Preparation.—Dissolve the whole of the ingredients in the alcohol during 12 hours, frequently shaking. One application gives an ebony black coat to the object. The varnish if filtered will never form a deposit.

Varnish for Bamboos.

Ingredients.—3 ozs. white shellac, 10 fluid ozs. methylated spirit.

Preparation and Use.—Dissolve and apply to the bamboo with a camel's hair brush. A beautiful transparent coating, which shows the natural colour of the wood, results.

Basket Varnish.

Ingredients.—8 ozs. orange shellac, 1 oz. yellow resin, ½ oz. benzoin, ¼ oz. Bismarck brown, 1½ pint methylated spirit, ½ pint vegetable naphtha.

Bessemer's Varnish.

This consists of a pale oil copal varnish diluted with about six times its volume of oil of turpentine, the mixture being subsequently agitated with about $\frac{1}{30}$th part of dry slaked lime, and decanted after a few days' repose. Five parts of the product mixed with 4 parts of bronze powder form Bessemer's gold paint.

Black Varnish for Straw Hats.

Ingredients.—$\frac{1}{2}$ oz. best black sealing-wax, 2 ozs. rectified 90 per cent. alcohol.

Preparation.—Powder the wax and digest in the alcohol by means of a water bath; apply the fluid warm with a fine soft hair brush before a fire or in the sun.

Soft Brilliant Varnish.

Ingredients.—6 ozs. sandarac, 4 ozs. genuine elemi, 1 oz. anime, $\frac{1}{2}$ oz. camphor, 1 quart alcohol.

Dissolve the camphor in the spirit, and then dissolve the resins in the usual way.

Varnish for Bottle Caps.

Ingredients.—2 ozs. gamboge, 2 ozs. ruby red shellac, 1 oz. Venice turpentine, 20 ozs. strong alcohol.

Stoppers for Varnish Bottles.

Varnish bottles are best closed with stoppers formed of good and pure wax, or corks may be used which have previously been mixed in molten wax. If corks are employed with no wax coating, they very often stick fast in bottles, and particles are often removed which render the varnish impure.

Brass Coloured Varnish.

Ingredients.—1 oz. shellac, 1 oz. sandarac, $\frac{1}{2}$ pint alcohol 90 per cent.

Chinese Varnish.

No. 1. *Ingredients.*—1 part of shellac, 15 parts alcohol, a small piece of camphor.

Dissolve by the sun's heat, shaking, and strain.

No. 2. *Ingredients.*—2 ozs. mastic, 2 ozs. sandarac, 20 fluid ozs. strong alcohol.

Dissolve. Dries in six minutes.

Collodion Varnish.

Ingredients.—1 oz. castor oil, 1 quart collodion.

Mix, and use for varnishing maps, &c.

Lessing's Colourless Varnish.

Ingredients.—2½ ozs. shellac, 1 pint alcohol 90 per cent., 5 ozs. well-burnt and recently-heated animal charcoal.

Preparation.—Boil a few minutes. A small portion of the solution should then be filtered, and if not colourless more charcoal must be added. When all colour is removed, press the liquor through a piece of silk and afterwards filter through fine blotting-paper. This kind of varnish should be used in a room at least 60° F., perfectly free from dust. It dries in a few minutes, and is not liable afterwards to chill or bloom. It is particularly applicable to drawings and prints that have been sized, and may be advantageously used upon oil-paintings which are thoroughly hard and dry, as it brings out the colours with the purest effect. This quality prevents it from obscuring gilding, and renders it a valuable varnish for all kinds of leather, as it does not yield to the warmth of the hand and resists damp, which subjects leather to mildew. Its useful applications are very numerous, indeed to all the purposes of the best hard spirit varnish.

Varnish for Confectionery.

"Take ½ lb. or more of gum benzoin, put it into a bottle and cover it with finest proof alcohol, cork up tightly and let it digest for at least two weeks, shaking up once or

twice a day, after which time you may gently pour off any quantity you may require for present use. It should be the thickness of thin syrup; if used too thick it is apt to appear in streaks on the work when dry; if too thick dilute it with alcohol. This varnish is perfectly harmless and very fragrant, resembling somewhat the odour of vanilla. It will also keep for years, growing better with age. It is a nice varnish for all kinds of chocolate work and candies, pulled and clear. It forms, when dry, a thin glossy film, or skin, over them, which prevents the access of the moisture of the surrounding atmosphere, and tends to keep them from becoming sticky for a much longer period of time."

Varnish for Cotton Cloth.

(So that it can be written on.)

Apply to the fabric a preparation of gum (gum-arabic and water), and allow it to dry, then press the place with a moderately hot iron. If the fabric is glazed or starched it is best to wash out the starch before applying the preparation.

Davies' Varnish.

Ingredients.—30 grains india-rubber in shreds, 4 ozs. Egyptian asphaltum, 10 ozs. mineral naphtha.

Preparation.—Dissolve the india-rubber in the naphtha, then add the asphaltum; use heat if necessary (not a naked flame, but a water bath).

Varnish for Dry Plates (Othmann's Formula).

Ingredients.—2 ozs. commercial japanner's gold size, 2 ozs. refined benzole. Apply when the plate is perfectly dry, but not warm. Drain off the excess of varnish and let the plate dry over night.

Varnish for Earthenware.

Equal parts of pulverised glass and soda are mixed; the mixture is then dried over a good fire and spread upon burnt vessels while they are still hot.

Electrical Varnish.

Ingredients.—Orange shellac, alcohol. Dissolve; to give whatever colour is desired add pigments—red and black being mixed for brown, red and blue for purple, yellow ochre or chrome yellow for yellow, calcined lampblack for a dead black.

Varnish for Engraving on Glass.

No. 1. *Ingredients.*—1 oz. wax, ½ oz. mastic, ¼ oz. asphaltum. Digest in ½ drachm turpentine.

No. 2. *Ingredients.*—7½ ozs. mastic, 3½ ozs. turpentine, 2 ozs. oil of spike.

No. 3. *Ingredients.*—1 oz. asphaltum, 4 ozs. wax, 2 ozs. mastic, 2 drachms turpentine.

Varnish for Fans.

Ingredients.—7½ ozs. mastic, 20 ozs. sandarac, 175 ozs. alcohol, 10 ozs. Venice turpentine. Dissolve in the alcohol, and then add the turpentine.

Ferrotype Varnish.

Ingredients.—12 parts white shellac, 58 parts alcohol 95 per cent. strong.

Dissolve, and add a few drops of oil of lavender.

Flexible Varnishes.

No. 1. *Ingredients.*—1½ oz. india-rubber (cut small), 20 fluid ozs. chloroform, ether, or carbon bisulphide.

Digest without heat until the solution is complete.

No. 2. *Ingredients.*—Similar to the last, but substituting gutta-percha for the rubber.

No. 3. *Ingredients.*—1 oz. india-rubber, 1 pint benzol. Digest with gentle heat; dries badly.

No. 4. *Ingredients.*—2 quarts linseed oil, 1½ oz. crude sulphate of zinc, 1½ oz. sugar (acetate) of lead, 4 ozs. litharge.

Preparation.—Boil with continual stirring until it strings well. Then cool slowly, and decant the cool portion. If too thick thin with quick-drying linseed oil.

No. 5. *Ingredients.*—1 oz. india-rubber, 1 quart drying oil.

Dissolve by as little heat as possible, constantly stirring, then strain. The above varnishes are useful for balloons, gas-bags, &c.

Varnish for Flowers.

The following varnish is recommended for coating the stalks of flowers for the preservation of their colour and general character :—

11 ozs. isinglass, 9 ozs. concentrated glycerine.

Preparation.—First soften the isinglass by soaking in cold water, and then dissolve in the glycerine by digestion and agitation, with the latter heated to 212° F. over a water bath. When properly prepared this varnish is colourless, and when cold resembles rubber in all but colour.

Another varnish recommended for this purpose is prepared from 1 oz. bleached gutta-percha, 7 ozs. deodorised benzole.

Preparation.—Cut the gutta-percha into fine shreds and gradually add it to the fluid with thorough shaking, warming the fluid in a suitable vessel over a water bath. Avoid a naked light with such a vapour-giving-off fluid as benzole, naphtha, or carbon bisulphide. The whole flower may be dipped into this varnish, shaken, and exposed to the air to dry. Another preparation suggested for this purpose is plain collodion diluted one-third and mixed with two per cent. of camphor, also dissolved, in a small quantity of ether and alcohol.

Varnish for Glass.

Ingredients and Preparation.—Dissolve gum tragacanth in white of an egg beaten up to a froth, allow it to stand for 24 hours; rub it gently on the glass with a soft brush.

Glass Varnish

is the name applied to a solution of sodium silicate or water glass. Fuse together 15 parts of powdered quartz (or of fine sand), 10 parts of potash, and 1 of charcoal. Pulverise the mass, and expose it for some days to the air, treat the whole with cold water, which removes the foreign salts, and boil the residue in 5 parts of water until it dissolves. It is permanent in the air, and not dissolved by cold water. This varnish is used to protect wood from fire.

Varnishing School Globes.

Varnish them with white hard varnish. It would be advisable to touch the chafed places up first with a little gum water in which a little sugar candy is put before revarnishing, to keep the paper from absorbing the varnish.

Guaiacum Varnish.

Ingredients.—2 ozs. shellac, 2 ozs. gum guaiacum, 18 ozs. methylated spirit. Powder the gum, dissolve in the spirit, filter, and add the shellac. Keep in jar surrounded by warm water until dissolved.

Varnishes for Gun Barrels.

Ingredients.—1½ oz. shellac, 3 drachms dragon's blood, 1 quart rectified spirit. Apply after the barrels are browned.

Varnish for Gunstocks.

Ingredients.—5 ozs. shellac, ½ oz. sandarac, 1 drachm Venice turpentine, 2 quarts alcohol. Dissolve.

Gutta-percha Varnish.

Clear 4 ozs. gutta-percha in warm water from adhering impurities, dry well, dissolve in 1 lb. rectified resin oil, and add 2 lbs. linseed oil varnish boiling hot.

Hair Varnish.

Ingredients.—1 part fine chopped hog's bristles, 10 parts drying oil. Dissolve by heat. Used to give the appearance of horsehair to cloth.

India-rubber Varnish.

No. 1. *Ingredients and Preparation.*—2 ozs. india-rubber finely divided, placed in a phial and digested in a sand bath with 4 ozs. of camphene and 4 ozs. of naphtha; when dissolved add 1 oz. copal varnish, which renders it more durable.

No. 2. *Ingredients and Preparation.*—Digest in a wide-mouthed glass bottle 2 ozs. of india-rubber in shavings with 1 lb. of oil of turpentine during two days without shaking, then stir up with a wooden spatula, add another pound of oil of turpentine, and digest with frequent agitation until all is dissolved. Mix $1\frac{1}{2}$ lb. of this solution with 2 lbs. of white copal oil varnish and $1\frac{1}{2}$ lb. of boiled linseed oil. Shake and digest in a sand bath until they have united into a good varnish.

No. 3.—4 ozs. india-rubber in fine shavings dissolved in a covered jar, by means of a sand bath, in 2 lbs. of crude benzole, and then mixed with 4 lbs. of hot linseed oil varnish and $\frac{1}{2}$ lb. of oil of turpentine. Dries well.

Inflexible Varnish.

Ingredients.—4 ozs. shellac, 1 pint wood naphtha, lamp-black q.s. to colour. Dissolve.

Insulating Varnishes.

No. 1. *Ingredients and Preparation.*—Put 1 oz. of shellac into a wide-mouthed 8-oz. phial containing 5 ozs. of well-rectified wood naphtha. Close the bottle with a cork, and let it stand in a warm place until perfectly dissolved. Shake the mixture frequently, and pass the fluid through a paper filter; add rectified naphtha to the solution from

time to time in such quantities as will enable it to percolate freely through the filter. Change the filter when necessary.

No. 2.—For silk-covered wire mix 6 ozs. boiled linseed oil and 2 ozs. rectified spirit of turpentine.

No. 3.—For large coils.

Cotton-covered wires are steeped in melted paraffin to increase their insulation. Large electro-magnet coils have a double covering of cotton, and the outer layer is coated with a thick varnish of shellac dissolved in alcohol.

No. 4.—Red varnish for wood, &c.

Sealing-wax dissolved in alcohol, and painted on with a brush in successive thin layers, say four or five.

No. 5.—For galvanometer coils.

Gum copal dissolved in ether painted over each layer of wire and dried on a stove.

Varnishes for Labels.

No. 1. *Ingredients.*—1 oz. camphor, 2 ozs. resin, 4 ozs. sandarac, 24 ozs. alcohol. Dissolve.

No. 2. *Ingredients.*—Canada balsam and turpentine in equal parts. Size the labels with gum water before varnishing.

No. 3. *Ingredients.*—53 ozs. sandarac, 22 ozs. mastic, 1 oz. camphor, 8 ozs. lavender oil, 4 ozs. Venice turpentine, 6 ozs. ether, 40 ozs. alcohol. Digest all in the spirit until dissolved. The result is a limpid, colourless, brilliant varnish which dries quickly, and is not too brittle.

No. 4. *Ingredients.*—6 ozs. African copal, 6 ozs. powdered glass, 1½ oz. camphor, 25 ozs. ether, 6 ozs. alcohol.

Preparation.—Powder the camphor and put it in a bottle with the glass, camphor, and ether, close well, and digest several weeks, frequently shaking, then add the alcohol, shake and digest another two weeks, then pour off the clear portion of the varnish. Size the labels with a solution of isinglass, in spirit 1 part, and water 3 parts.

No. 5.—Use hot melted paraffin wax, apply a thin coat by means of a flat fine brush. This varnish dries almost at once, whereas other varnishes require several days.

Mastic Varnishes.

No. 1. *Second quality.*—1 lb. mastic, ½ gallon turpentine, dissolve by heat, and add ½ pint turpentine varnish.

No. 2.—6 ozs. mastic, 1 quart turpentine. Dissolve.

No. 3.—1 oz. clearest mastic, 1 part spirit of turpentine. Dissolve by sand bath. Strain through fine sieve, and if too thick thin with spirit of turpentine.

Varnish for Iron and Steel.

Ingredients.—10 ozs. mastic, 5 ozs. camphor, 15 ozs. sandarac, 5 ozs. elemi, alcohol q.s. Dissolve. Apply cold.

Mordant Varnish.

Good mastic varnishes are tough, hard, brilliant, and colourless.

No. 1. *Ingredients.*—1½ oz. mastic, ½ oz. gamboge, 1½ oz. sandarac, ⅜ oz. turpentine. Dissolve in 9 ozs. spirit of turpentine.

No. 2. *Ingredients.*—9 ozs. spirit of turpentine, 1½ oz. sandarac, ⅜ oz. gamboge, 1½ oz. mastic. Dissolve.

No. 3. *Ingredients.*—12 ozs. spirit of turpentine, 2 ozs. mastic, 2 ozs. sandarac, 1 oz. gamboge, ½ oz. turpentine.

A very simple mordant is made by dissolving a little honey in thick glue; it heightens the colour of the gold, and the leaf adheres well.

Varnish for Nets.

No. 1.—Waterproof and pliable. Dissolve soft soap in hot water, and add a solution of sulphate of iron. An insoluble iron soap (ferrous sebate) is precipitated, which

collect, wash, and dry; then mix to the right consistency with linseed oil, and it is ready to apply.

No. 2.—"Fine paraffin wax, melted with a small portion of raw linseed oil. Both for lines and nets. See that they are perfectly dry before putting them into the above hot, and you will say you have found nothing to equal it. When you take them out, wring them dry before the fire in an old duster or cloth."

To Varnish Plaster of Paris Casts.

Ingredients.—½ oz. white soap, ½ oz. wax, 2 pints water. Boil together for a short time in a clean vessel, let the mixture cool, and then apply with a soft brush. It does not soak in; it dries readily, and its effect may be heightened by lightly using a silk handkerchief.

Varnish for Pocket-Books.

Ingredients.—6 ozs. mastic in tears, 3 ozs. coarsely-powdered glass sifted from the dust, 32 ozs. spirits of wine of 40 per cent. Dissolve by aid of sand bath, let the mixture come to the boil, and stir well. When thoroughly mixed, stir in 3 ozs. spirits of wine; boil for half an hour, remove, cool, strain through cotton cloths. Be careful that the mixture does not become overheated and inflame. Use a closed fire, and watch incessantly. To quench the flame if the mixture ignites, cover it all over with a thick woollen cloth, rug, carpet, &c., stopping all draught-holes.

Shellac Varnish for Rubber.

Powder shellac, and digest in ten times its weight of flower of ammonia. The mixture takes a long time for dissolution. Mixed with lampblack this varnish is useful for goloshes or overshoes.

Shellac Varnish.

Ingredients.—60 grains shellac, 63 grains alcohol. Dissolve and heat until quite thick, then add a little solution

of aniline dye dissolved in alcohol, and for every 60 grains of the mixture add 25 grains of castor oil, and heat for a short time.

Imitation Shellac Varnish.

(Used by furniture dealers.)

Ingredients.—1½ lb. sandarac, 1½ lb. pale resin, 2 gallons benzine. Dissolve by gentle heat. Dries quickly.

Sign Painter's Varnish.

Ingredients and Preparation.—To 2 quarts drying linseed oil add 2 lbs. best copal, ⅛ lb. lead acetate, ⅞ gallon turpentine. Boil the copal for several hours until very thick; thin with the turpentine.

Theatrical Varnishes, for affixing Moustaches, &c.

4 parts resin, 1 part oil Ricini, 16 fluid parts methylated spirit. Dissolve, strain, and perfume.

Tray Varnish.

This varnish is similar to common spirit varnish, but carefully-rectified wood naphtha must be used as a solvent.

Varnish for Photographer's Trays.

Use asphaltum varnish, or coat the bottom or sides of the wooden trays with 1 part resin, 2 parts beeswax, 8 parts paraffine (all by weight). Melt the above first, warm the tray, and while hot apply the compound with a brush.

Umbrella Varnish.

Ingredients.—10 parts pulverised litharge and 20 parts turpentine boiled in 20 parts linseed oil. Dry in the sun.

Waterproof Varnishes.

No. 1.—For waterproofing textile fabrics, boil together 2 quarts linseed oil and ½ lb. flour of sulphur.

No. 2.—5 lbs. oxide of lead, 2½ lbs. lampblack, 6¾ ozs. sulphur, 12½ lbs. india-rubber dissolved in turpentine. Boil until thoroughly mixed.

No. 3.—Soften 4 ozs. india-rubber in ½ lb. of oil of turpentine; then add 2 lbs. boiled oil and boil for two hours over a slow fire. When dissolved, add 6 lbs. of boiled linseed oil and 1 lb. of litharge, and boil until an even liquid is obtained. Apply warm.

Wax Varnish (to preserve Statues and Marble exposed to Air).

Melt 2 parts wax in 8 parts pure essence of turpentine. Apply, and spread evenly so as not to destroy the lines of the figures. This varnish may be used upon statues which have been cleansed with water and washed with hydrochloric acid; but they must be perfectly dry when the application is made.

Spirit Gold Lac Varnishes.

No. 1. *Ingredients.*—33 ozs. shellac, 66½ ozs. gamboge, 4 ozs. dried saffron, 133 ozs. alcohol.

Preparation.—Powder the resin and rub it up with the saffron, and dissolve in the alcohol by tying it up in a piece of perforated bladder and suspending in the neck of the vessel. Heat by water bath.

No. 2. *Ingredients.*—16½ ozs. of shellac, 8 ozs. dragon's blood, 8 ozs. turmeric, 4 ozs. gamboge, 100 to 133 ozs. alcohol. Treat as in No. 1.

No. 3. *Ingredients.*—16½ ozs. shellac, 2 ozs. dragon's blood, 1 oz. saffron, digested in 400 to 600 ozs. alcohol for eight days in the sun, and then filtered.

No. 4. *Ingredients.*—66½ ozs. seedlac, 66½ ozs. sandarac, 33 ozs. turpentine, 8 ozs. dragon's blood, 1 oz. gamboge,

1 oz. turmeric, 66½ to 83 ozs. pulverised glass, and digest the whole in 800 ozs. alcohol.

No. 5. *Ingredients.*—15 ozs. seedlac, 30 ozs. sandarac, 30 ozs. elemi, 15 ozs. dragon's blood, 10 ozs. turmeric, 10 ozs. gamboge, ½ oz. saffron, and 30 to 50 ozs. pulverised glass in 250 to 300 ozs. alcohol.

No. 6. *Ingredients.*—66½ ozs. shellac, 25 ozs. sandarac, 16½ ozs. mastic in grains, 50 ozs. yellow resin, 16½ ozs. yellow amber, 16½ ozs. dragon's blood, 12 ozs. gamboge, 12 ozs. turmeric (and if a deeper colour is desired, 15 ozs. of aloes). Digest the whole in 1000 ozs. alcohol.

Gold Varnish without Lac.

Ingredients.—16½ ozs. copal, 8 ozs. white boiled turpentine, 2 ozs. camphor in alcohol. Then prepare a solution of 16½ ozs. of sandarac, 8 ozs. mastic, 4 ozs. dragon's blood, 8 ozs. gamboge, 4 ozs. annatto, 2 ozs. aloes in spirits of wine. Mix the two.

Copal Varnish with Spirit of Sal-ammoniac.

Ingredients and Preparation.—Convert copal into a coarse powder, and gradually pour spirit of sal-ammoniac over it until the whole is swelled up to a thick transparent mass. Heat this to 100° F., then mix it gradually with alcohol 75 to 80 per cent.; shake it thoroughly, and finally add more alcohol to give the mixture the requisite consistency.

Pitch Varnish for Buildings.

Ingredients and Preparation.—1 lb. linseed oil, 150 lbs. of pitch, 120 lbs. litharge; boil over a coal fire, and stir until they are intimately mixed. Apply one, or, if necessary, several coats of this varnish to the weather side of the buildings, which will render them impervious to moisture. The above quantity suffices to give four coats to 10 square feet of surface.

Oil of Turpentine Varnishes.

These varnishes are usually prepared in the same manner as spirit varnishes, but as turpentine is not so volatile (*i.e.* its boiling point is higher) as alcohol and other solvents used in volatile varnishes, it is not necessary to use the same precautions against the loss by evaporation of the solvent. A general practice for the dissolution of resins in turpentine is to place them in a linen bag and suspend them in the neck of the vessel, which should be four-fifths filled with oil of turpentine. The vessel should then be placed up to about a quarter of its height in sand piled upon the plate of an ordinary stove. A glass funnel containing a sponge, which has to be moistened from time to time, is placed upon the bottle. The loss of oil caused by evaporation is so small that it need not be taken into consideration. A good substitute for a sand bath can be improvised out of an old frying-pan, as the long handle of which serves very conveniently to remove the bath and containing vessel from the fire as required. When only a gentle heat is required, a hanging frying-pan, such as are sold in country districts, is very convenient, as this can be suspended from the iron peg that draws out over the fire in a country-made grate. An old iron saucepan also forms a good vessel for improvising a water bath.

Dammar Varnish.

Ingredients.—40 to 45 ozs. dammar resin, 50 to 60 ozs. of oil of turpentine. The preparation of this varnish requires a peculiar treatment, namely, dammar resin can only be dissolved in oil of turpentine when that fluid contains no water. If water is present, the resin is absolutely insoluble. The most economical and rational means of dissolving dammar resin in turpentine is to proceed as follows:—First heat the resin for a short time to 105° to 110° C. (221° to 230° F.), and then heat it with a very small quantity of oil of turpentine to bring the latter to the boiling point; then it will form a very thick solution, furnishing at once ready varnish when reduced with a sufficient quantity of oil of turpentine.

Dammar Varnish (Mixed).

Ingredients.—80 ozs. dammar resin, 4 to 5 ozs. linseed oil, 100 ozs. oil of turpentine.

Preparation.—Boil the linseed oil for a few hours with the resin and a little turpentine. This varnish is not quite so light as that made with turpentine alone, but it can be laid on with less difficulty.

Varnish for protecting Chemicals from Effects of Light.

A varnish which can be applied to the outside of glass chemical bottles is made by dissolving asphaltum in tar oil; but common amber, first melted, and then dissolved in chloroform, answers equally as well. This varnish can be laid on the outside of the vessel with a brush or poured in, and the bottle rolled round to coat the inside; colour can be given to this varnish by the usual colouring bodies, and if it be desired to dissolve it a few drops of caustic liquid ammonia is all that is required.

Tar Oil and Copal Varnish.

Ingredients.—4 ozs. light-coloured copal, 2 ozs. American pine resin, 1 oz. sandarac, 1 oz. Venetian turpentine, 20 ozs. varnish oil.

Preparation.—Carefully melt the copal together with the pine resin, then add the sandarac and turpentine, and finally the varnish oil. The mass should be fluid, but no longer hot; it should be well stirred before adding the varnish oil. Filter through cotton wool or cotton in a covered funnel.

Painter's Varnish with Tar Oil.

Ingredients.—100 ozs. linseed oil, 6 ozs. litharge, 40 ozs. American pine resin, 20 ozs. tar varnish oil.

Preparation.—Boil the litharge with the linseed oil and pine resin until the mass begins to draw threads in cooling;

then, while hot, mix it with the varnish oil. This varnish dries very quickly on account of the volatility of the varnish oil, and must, therefore, be kept in well-closed vessels.

Coal Asphaltum Lacquer.

"When tar is distilled there remains finally in the distilling apparatus a mass which, when cold, assumes a glossy black appearance, and shows some of the qualities of excellent asphaltum. This tar asphaltum is particularly well adapted for the fabrication of lacquers, and in the following we give a few directions for preparing such lacquers, which may be used for various purposes. If dissolved in volatile oil and used by itself, coal asphaltum, to be sure, produces lacquers of a beautiful black colour and great lustre, but they are quite brittle. Thus asphaltum is, therefore, mostly used for the fabrication of lacquers in connection with other bodies, and substances possessing the property of decreasing this brittleness are employed for this purpose. The following directions will serve for preparing a coal asphaltum lacquer which can be used equally well for glass, wood, leather, and metal:—

"100 parts of coal tar asphaltum are melted together with 40 parts of colophony, and then mixed with 20 parts of linseed oil varnish. When this has been intimately mixed together, 40 parts of oil of turpentine, and a similar quantity of tar varnish oil, are added to the mass. The mixture is ready when a sample rubbed upon a glass plate solidifies to a glossy black colour in a quarter of an hour.

"If the sample should show no lustre a few pounds of tar oil varnish are added to the mass, and thoroughly mixed with it."

Tar Asphaltum Lacquer.

Ingredients.—30 lbs. West Indian copal, 30 lbs. American pine resin, 30 lbs. mineral asphaltum, 30 lbs. tar asphaltum, 6 lbs. yellow wax, 6 lbs. Venetian turpentine.

Preparation.—Melt these bodies together, and intimately mix by stirring; thorough incorporation of all the components is readily recognised by the melted mass running off in a

uniformly thick stream from the spatula to the melted mass, and when it is still moderately warm add 12 lbs. resin oil, 30 lbs. linseed oil varnish, 30 lbs. oil of turpentine, 30 to 45 lbs. benzole; the benzole must be added last, and the quantity of this ingredient depends on the object for which the lacquer is to be used. If it is desired to produce a thinly fluid lacquer more benzole has to be used. The more thinly fluid the lacquer is, the more beautiful and durable will it be. On account of its great lustre this lacquer can also be used for the manufacture of the so-called Japanese wares. It will take a very beautiful gloss by repeatedly rubbing it with a flannel rag.

Double Asphaltum Lacquer.

Ingredients.—18 lbs. mineral asphaltum, 18 lbs. tar asphaltum, 18 lbs. American pine resin, 10 lbs. linseed oil varnish, 10 lbs. oil of turpentine, 10 lbs. light coal tar oil, 20 lbs. benzole, 2 lbs. lampblack.

Preparation.—First melt the natural asphaltum together with the colophony, then add the tar asphaltum, and when these bodies are uniformly mixed together the other fluids are added, the linseed oil being ground up with the lampblack, and added last.

Caoutchouc Varnishes.

These varnishes possess the exceedingly valuable property of offering a complete resistance to the influence of water; thus they are superior to all other varnishes which are materially affected by that fluid. Another good quality of these varnishes is that they possess great elasticity; thus a coat of caoutchouc varnish will show no cracks. There are numerous solvents used for preparing these varnishes, but bisulphide of carbon, ether, and oil of turpentine are especially used for the purpose. The oil of caoutchouc, gained in the dry distillation of caoutchouc, possesses scarcely a greater solving power than the oil of turpentine, but the latter is by far the cheaper. Benzole is particularly useful for dissolving caoutchouc, and is in fact preferable to

carbon bisulphide, because the vapours of the rather offensive smelling fluid are positively dangerous to the health of the operator. Strictly speaking, every solution of caoutchouc is already a varnish, and such solutions are particularly well adapted where a colourless coating, and one which will not crack, is desired. Copperplates and maps can be very well coated with a simple solution of caoutchouc in carbon bisulphide. The best method for preparing these varnishes is to allow the caoutchouc to swell up in the liquid, and to effect the final solution by adding benzole and placing the vessel in warm water; the solutions should remain standing as long as possible upon the undissolved residuum to become clear. They are then carefully poured off into other bottles and stored away until they are to be used. But as this solvent is very volatile, the bottles should be tightly corked; ground glass stoppers are the best. Varnishes containing other varnish, especially copal varnish, besides caoutchouc, possess the good qualities of both varnishes, though they dry somewhat slower than the pure caoutchouc varnish. But the last-named quality may be rather an advantage than otherwise, as solutions of caoutchouc in benzole or bisulphide of carbon dry so quickly as to require special skill to apply them in a uniform layer.

Caoutchouc Varnishes.

Ingredients.—1 part caoutchouc, 10 parts bisulphide of carbon.

Preparation.—Cut up the caoutchouc in small pieces, put it in a bottle, cover with the liquid, cork up, and put in a moderately warm place—not too warm, or the bottle is liable to burst from the vaporisation of the fluid. The caoutchouc swells up very much, but dissolves only partly, and after standing for a long time forms a clear solution over a slimy sediment. Pour off the solution very carefully. Benzole dissolves caoutchouc better. Gradually add some of the fluid to the caoutchouc until the latter is changed into a jelly; then reduce the mixture with light tar oil (having a density of 0·84 to 0·85), and filter. The most complete solution is obtained by pouring benzine over the pieces of

caoutchouc which have been treated with bisulphide of carbon, and mixing the solutions together.

This varnish dries very rapidly, leaving a very thin film behind; thus it is useful for coating metal, paper, &c. The layer of varnish has neither colour nor lustre, is therefore invisible, and articles varnished with it can be cleaned with a moist sponge. If a tissue is dipped into this varnish, or painted over with it, the stuff will be made waterproof, and fine cotton or silk goods treated in this manner assume a very peculiar transparent appearance. If this varnish be applied to burns, the pains of them cease, as it excludes the air from them, and then they heal quickly.

This varnish is one of the best means of rendering articles waterproof. Matches and rockets dipped several times into this varnish may be in water for hours without losing their inflammability.

Elastic Caoutchouc Varnish.

Ingredients.—$2\frac{1}{5}$ lbs. colophony, $17\frac{1}{2}$ ozs. of caoutchouc cut up small, $2\frac{1}{5}$ lbs. hot linseed oil.

Preparation.—Heat the resin until it begins to emit vapour, then gradually add the small pieces of caoutchouc; constantly stir, and when the mixture has become quite uniform, put in the hot linseed oil, a portion at a time. Then heat the whole until disagreeably smelling vapours begin to be evolved. Take the vessel from the fire and continue stirring the mixture until it becomes cold. The varnish thus prepared can be used as a perfect waterproof coating for leather and tissues, and such articles coated with it can be repeatedly bent without cracking the leather. If common petroleum be used to dissolve caoutchouc, very unsatisfactory results are obtained, as the fluid must be almost entirely free from water before it will dissolve caoutchouc. To free petroleum from water, treat it with sulphuric acid, thus: mix 11 parts by weight of concentrated sulphuric acid with 10 parts by weight of the petroleum in a vessel provided with a stirring apparatus (or mixer). After well stirring, allow the two fluids to separate by standing at rest, and then draw off the petroleum into a suitable vessel, and add 3·3 parts of litharge and

1 part of pyrolusite (sesquioxide of manganese); thoroughly shake the bottle or vessel and leave the mixture undisturbed to clear. Petroleum treated in this manner is an excellent solvent for caoutchouc, and should be used especially in all cases where it is desired to obtain a varnish which will dry quickly.

Hard Caoutchouc Lacquer.

Old combs of hard caoutchouc, or other waste caoutchouc, can be utilised in preparing this excellent lacquer, which may be used for all purposes. Melt the hard caoutchouc in small quantities in an iron pot, keep constantly stirring meanwhile, to prevent the mass from burning to the pot. When all has been melted, pour the fluid mass upon a tin plate, and break it into pieces after it has become cold. Put these pieces, which resemble glossy black pitch, into a bottle with five to ten times their quantity of rectified oil of turpentine. Instead of using oil of turpentine alone, a mixture of equal parts of this and benzole may also be used, which will dissolve the caoutchouc in a very short time. When the best part of the mass is dissolved, pour it off from the sediment carefully, and a dark-brown lacquer is obtained which furnishes an excellent coating for metal, and when repeated often gives it a glossy black colour resembling that of the hard caoutchouc itself.

Fat Varnishes.

These varnishes are prepared with the hardest resins, copal, or amber, and they are the most valuable of all varnishes, as they are durable, glossy, glass-like in appearance, the beauty of which diminishes only after a long time, even if exposed to atmospheric influences. They possess considerable elasticity, and finally do not crack or peel off. These varnishes are as easy to make as spirit lacquers. The chief point to attend to is, that a complete solution of the resins in the fat oils takes place, and that the resins be not merely changed to a slime-like mass. Apparently the simplest method of preparing fat copal varnish would be by intimately mixing copal dissolved in any volatile

solvent with a good linseed oil siccative, and by evaporating the solvent by heating the varnish in a distilling apparatus. The solvent could be regained by cooling off, while the dissolved copal would remain in the fat oil. But, as is well known, such a process would require the use of thoroughly melted copal; but the cost of the latter would be considerably higher than if the work were done with the ordinary, *i.e.* undistilled copal, as a considerable loss of volatile products is caused by dry distillation. In practice, it is therefore the object to at least reduce as much as possible the loss caused by distilling the copal; this may be done by heating the copal only to such a degree that it appears to be entirely melted, and by trying to unite the melted mass with the linseed oil.

Fat copal varnish by boiling can only be obtained of faultless quality by special skill, as it is not by any means easy to hit the exact moment when the copal unites with the oil, that is to say, their union takes place only at a certain degree of heat.

Formula for Copal Varnish.

As the quality of copal varies, so must the quantity of oil of turpentine needed vary, according as the copal is hard or soft. Thus, if hard East Indian copal be used, a smaller quantity is needed, and a larger proportion of oil of turpentine, to produce a good varnish; but if soft copal be used, the quantity of it must be increased, and that of the oil of turpentine lessened. In case the copal that is used has never been worked with before, it will be necessary to experiment a little so as to ascertain the exact quantity of each.

Ingredients.—28 to 32 lbs. copal, 100 lbs. linseed oil, 2 to 3 lbs. litharge, 70 to 80 lbs. oil of turpentine.

Preparation.—Boil the oil in the gum-pot until it begins to throw up small bubbles, keep the oil at this temperature, during which time melt one-fourth of the quantity of copal varnish over an open fire in a small boiler, having ears provided with wooden handles. Very great care and attention is required on the part of the workman during

this melting process ; the resin must be stirred continually, and should the separate pieces commence to cohere strongly to each other, the more solid pieces must be dipped under the formed fluid in such a manner as to keep all parts in as uniform a heat as possible. Finally the resin is melted, and when heated further, begins to throw up bubbles and to smoke ; this is the moment when the melted resin must be mixed with the hot linseed oil.

"With a ladle holding about twice as much oil by weight as the quantity of copal melted at one time, the hot oil is dipped from the boiler and allowed to flow in a very fine stream through the narrow spout of the ladle into the melted copal. In the meanwhile the mass must be stirred very quickly and without intermission until the contents of the boiler form a uniform flowing mass.

"The small boiler is then placed alongside of the large boiler to keep it hot, and the same operation is repeated in another boiler with another fourth part of the quantity of copal. This boiler is also kept warm, and a third and fourth boiler, containing the corresponding quantities of copal and oil, are taken in hand. When the work with the last (fourth) boiler is finished, all the solutions of copal are added to the linseed oil still remaining in the large boiler (gum-pot).

"The small boilers are quickly emptied in succession, and the contents of the larger boiler are now continually and uniformly stirred, as a considerable quantity of viscid solution of copal remains adhering to the sides of the small boilers. This must be gained as quickly as possible. As soon as the solution has been poured into the large boiler, a ladleful of oil of turpentine is poured into the small boiler, which has been first thoroughly heated, and an attempt is made to detach as quickly as possible the solution of copal adhering to the sides of the boiler, and to mix it with the oil of turpentine. It is best to use for this purpose a supple spatula of hard wood, which may be easily bent into a form corresponding to that of the side of the boiler. Ratan covered with rubber is also very suitable for this purpose. When the sides of the boiler have become bright, which may be easily observed by tilting the boiler a little,

the four boilers are allowed to stand in a warm place until the lacquer in the large boiler is done.

"The linseed oil in the boiler, now containing the entire quantity of copal to be used in solution, must now be boiled into varnish. As has been mentioned in the foregoing receipt, litharge may be used for this purpose, though we" (*i.e.* Winckler and Audés) "have used borate of manganese for a long time, and with the best success (0·25 part of borate of manganese is sufficient for 100 parts of linseed oil). The litharge, or borate of manganese, is allowed to fall gradually into the solution, which, in the meanwhile, is stirred very strongly, and the temperature is raised to the necessary degree. The scum appearing on the surface of the oil must be constantly removed.

"When the fluid has been boiled for two hours, counting from the time when the litharge was added, tests are commenced to be made. When a spatula is dipped into the fluid, the lacquer should adhere to it in a thick layer, and drop from it in transparent golden threads, becoming very thin towards the last. By the so-called drop test, a drop of the lacquer when allowed to fall upon glass should form a high arch, and when cold should be of the consistency of thick, thread-drawing syrup. Firing is discontinued as soon as this phenomenon appears, and the contents of the boiler are allowed to cool off to about 60° to 70° C. (140° to 158° F.), and then the oil of turpentine contained in the four small boilers is added.

"The remaining quantity of oil of turpentine must not be added in too large portions. First about 10 per cent. of the quantity of turpentine is added, and later only 5 per cent., and the fluid should be tested every time after it has been thoroughly stirred. As long as the tested fluid is yet viscid in a corresponding degree, after it has become cold, and quickly becomes thick, more oil of turpentine may be added. But if it is observed that the fluid already becomes less viscid after only a small quantity of oil of turpentine has been added, it is a sure proof that the limit of adding oil of turpentine has been reached, and that the quality of the varnish would be injured by adding any more.

"Well-prepared copal lacquer should be viscid, and have

a light golden colour; should be easy to apply, and without forming streaks, and should become completely dry in from six to twelve hours."

From the above description it will be seen that the operation of copal varnish making is very complicated: two workmen at least being required, and these only when experienced; if they are not, a third one is necessary to do the constant stirring. Copal varnish may also be prepared without boiling; but as a description of such process is outside the limits of this work, we omit details.

White Copal Varnish.

Ingredients.—4 ozs. copal, ½ oz. camphor, 3 ozs. white drying oil, 2 ozs. essential oil of turpentine.

Preparation.—Powder the copal; mix the camphor and drying oil; then heat on a slow fire, and add the oil of turpentine, and strain.

Copal Varnish.

Ingredients.—1 part of camphor, 12 parts (by weight) of ether, 4 parts clear copal, 4 parts absolute alcohol, ¼ part essence of turpentine.

Preparation.—Dissolve the camphor in the ether, and add the copal to this, powdered fine. Let the mixture digest in a warm place, with frequent shakings; then add the alcohol and essence of turpentine. A viscid, almost homogeneous liquid should result. Set this aside for several days, when it will separate into two layers, the lower of which contains the most copal; but the higher stratum will be found to give the most brilliant varnish, although it is at the same time as limpid as water.

Copal Varnish with Ammonia.

Ingredients and Preparation.—Powder the copal, and pour ammonia over it until the whole mass swells up. Heat this to about 100° F.; then add alcohol until the mixture is of the desired consistency.

Best Body Copal Varnish for Coachmakers.

Ingredients and Preparation.—4 lbs. of fine African copal, add 1 gallon clarified oil; boil very slowly for four or five hours until quite stringy; mix off with 1¾ gallon of turpentine; strain, and store for use.

Turpentine Copal Varnish.

Ingredients and Preparation.—1 pint of oil of turpentine. Set the bottle in a water bath, and add, in small portions at a time, 3 ozs. of powdered copal that has been previously melted by a gentle heat and dropped into water. In a few days decant the clear. This varnish dries slowly, but is very pale and durable. It is used for pictures, &c.

Oil Copal Varnish.

No. 1. *Ingredients and Preparation.*—2 lbs. pale hard copal; add hot drying oil 1 pint; boil as before directed, and thin with oil of turpentine 3 pints, or q.s.

No. 2. *Ingredients and Preparation.*—4 lbs. clearest and palest African copal; fuse, and add 1 gallon hot and pale drying oil; boil till it strings strongly, cool a little and thin with hot rectified oil of turpentine 1½ gallon. This varnish is very fine. This and No. 1 are used for pictures.

Spirit Copal Varnish.

No. 1. *Ingredients and Preparation.*—4 ozs. copal in coarse powder, 4 ozs. glass, 1 pint alcohol 90 per cent., ½ oz. camphor. Heat the mixture in a water bath so that the bubbles may be counted as they rise, observing frequently to stir the mixture. When cold, decant the clear. Used for pictures.

No. 2. *Ingredients and Preparation.*—Copal melted and dropped into water, 3 ozs., sandarac 6 ozs., mastic and Scio turpentine of each 2½ ozs., powdered glass 4 ozs., alcohol of 83 per cent., 1 pint. Dissolve by a gentle heat. Used for metal, chairs, &c.

No. 3. *Ingredients and Preparation.*—Melt, in an iron pan at a slow heat, copal gum powdered 8 parts, and add balsam capivi, previously warmed, 2 parts. Then remove from the fire and add spirit of turpentine, also warmed beforehand, 10 parts, to give the necessary consistence. Gum copal is made more soluble in spirit of turpentine by melting the powdered crude gum and allowing it to stand for some time, loosely covered.

No. 4. *Ingredients.*—24 parts copal powdered, 40 parts spirit of turpentine, 1 part of camphor.

No. 5. *Ingredients and Preparation.*—16 parts copal in powder, 2 parts camphor, 90 parts oil of lavender. Dissolve the camphor in the oil, heat the latter, and stir in the copal in successive portions until complete solution takes place. Thin with sufficient turpentine to make it of proper consistence.

Amber Varnish.

No. 1. *Ingredients.*—1 lb. amber. Melt and add Scio turpentine 8 ozs., also 2 ozs. transparent white gum, 1 pint hot linseed oil, and afterwards oil of turpentine q.s., as above. This varnish is very tough.

No. 2. (Hard.) *Ingredients.*—4 ozs. melted amber, 1 quart hot linseed oil, as before.

No. 3. (Pale.) *Ingredients.*—4 ozs. very pale and transparent amber, 1 pint clarified linseed oil, and 1 pint oil of turpentine, as before.

Amber varnish is suited for all purposes where a very hard and durable oil varnish is required. The paler kind is superior to copal varnish, and is often mixed with the latter to increase its hardness and durability.

CHAPTER XIII.

FORMULÆ FOR MAKING, AND PROCESSES OF USING, JAPANS FOR WOOD AND METAL.

General Observations on Japanning.

"When finished wood, papier-maché, composition, or materials are varnished in the usual manner and left to dry in the air, the drying is in most cases imperfect, and the coating more or less uneven. If the surface thus varnished is heated for some time to a temperature of from 250° to 300° F. or higher, it is found that the whole of the solvent or vehicle of the gums or resins in the varnish is soon driven off, and the gummy residue becomes liquefied or semi-liquefied, in which state it adapts itself to all inequalities, and, if the coating is thick enough, presents a glossy surface, which it retains on cooling. This process of drying out and fusion secures a firm contact and adhesion of the gums or resins to the surface of the substance varnished, and greatly increases the density of the coating, which enables it to resist wear and retain its gloss longer.

"This process of hardening and finishing varnished or lacquered work by the aid of heat, constitutes the chief feature of the japanner's art.

"In practice, the work to be japanned is first thoroughly cleansed and dried. If of wood, composition, or other porous material, it is given while warm several coats of wood filler, or whiting mixed up with a rather thin glue size, and is, when this is hardened, rubbed down smooth with pumice-stone. It is then ready for the japan grounds.

Metal, as a rule, requires no special preparation, receiving the grounds directly on the clear dry surface.

"In japanning, wood and other substances require a much lower degree of heat, and usually a longer exposure in the oven, than metals; and again, a higher temperature may be advantageously employed when the japan is dark than when light-coloured grounds are used; so that a definite knowledge of just how much heat can be safely applied, and how long an exposure is required with different substances and different grounds, can only be acquired by practical experience. Large japanners seldom make their own varnishes, as they can procure them more cheaply from the varnish maker.

"The japanner's oven is usually a room, or large box constructed of sheet metal, and heated by stove drums or flues, so that the temperature—which is indicated by a thermometer or pyrometer hung up inside, or with its stem passing through the side wall midway between the top and bottom of the chamber—can be readily regulated by dampers. The ovens are also provided with a chimney to carry off the vapours derived from the drying varnish, a small door through which the work can be entered and removed, and wire shelves and hooks for its support in the chamber. The ovens must be kept perfectly free from dust, smoke, and moisture."

"A Good Cheap Gummy Varnish for Work

to be japanned consists of 2 parts shellac (pale), 2 parts resin (pale), 1 part of rectified spirit (two or three coats of this spirit on the work in a warm dry room). A good ivory black ground is prepared by grinding fine ivory black with a sufficient quantity of alcoholic shellac varnish on a stone slab with a muller until a perfectly smooth black varnish is obtained. If other colours are required, the clear varnish is mixed and ground with the proper quantity of suitable pigments in a similar manner; for red, vermilion or Indian red; green, chrome green or Prussian blue and chrome yellow; blue, Prussian blue, ultramarine, or indigo; yellow, chrome yellow, &c."

Recipes for Common Black Japan Ground.

No. 1. *Ingredients.*—1 lb. asphaltum, 1 lb. balsam of capivi, oil of turpentine q.s.

Preparation.—Melt the asphaltum over a fire, and having previously heated the balsam, mix that with the asphaltum; then remove the vessel from the fire, and put in the turpentine.

No. 2. *Ingredients and Preparation.*—Moisten good lampblack with oil of turpentine, and grind it very fine with a muller on a stone plate; then add a sufficient quantity of ordinary copal varnish, and rub well together.

No. 3. *Ingredients.*—3 ozs. asphaltum, 1 gallon boiled oil, 8 ozs. burnt umber, oil of turpentine q.s.

Preparation.—Melt the asphaltum, stir in the oil previously heated, then the umber; and when cooling, thin down with the oil of turpentine.

Superior Black Japan Ground.

Ingredients.—12 ozs. amber, 2 ozs. asphaltum purified, ½ pint boiled oil, 2 ozs. resin, 16 ozs. oil of turpentine.

Preparation.—Fuse the gum and resin and asphaltum, add the hot oil, stir well together, and when cooling add the turpentine.

Ordinary Black Japan Ground.

No. 1. *Ingredients and Preparation.*—Mix shellac varnish with either ivory-black or lampblack, but the former is preferable. These may be always laid on with the shellac varnish, and have their upper or polishing coats of common seedlac varnish.

No. 2. *Ingredients and Preparation.*—A common black may be made by covering a piece of work with drying oil and putting the work into a stove not too hot, but of such a degree as will change the oil black without burning it, gradually raising the heat and keeping it up a long time. This requires no polishing.

No. 3. *Ingredients.*—1 part asphaltum, 2 parts hot balsam of capivi, and when mixed, thin with hot oil of turpentine.

No. 4. *Ingredients and Preparation.*—Grind lampblack very smooth on a marble slab with a muller with turpentine, thin with hot oil of turpentine.

Japan Black for Metals.

Ingredients.—12 ozs. amber, 2 ozs. asphaltum. Fuse by heat, and add ½ pint boiled oil and 2 ozs. resin; when cooling, add 16 ozs. oil of turpentine.

Japan Black for Leather.

Ingredients.—4 ozs. burnt umber, 2 ozs. true asphaltum, 2 quarts boiled oil.

Preparation.—Dissolve the asphaltum by heat in a little of the oil; add the burnt umber ground up in oil, and the remainder of the oil; mix, cool, and thin with turpentine. This composition is very flexible.

A White Japan Ground

is prepared from copal varnish and zinc white or starch. "To form a hard perfect white ground is no easy matter, as the substances which are generally used to make the japan hard have a tendency by a number of coats to look or become dull in brightness. One white ground consists of the following composition: Flake white of lead is washed over and ground up with ⅙th of its weight of starch, then dried, and mixed with the finest gum ground up in parts of 1 oz. gum to ½ oz. of rectified turpentine, mixed, and ground thoroughly together. This is to be finely laid on the article to be japanned, dried, and then varnished with 5 or 6 coats of the following: 2 ozs. of the finest seedlac to 3 ozs. of gum anime reduced to a fine powder and dissolved in 1 quart of alcohol. The lac must be carefully picked. For a softer varnish than this, a little turpentine should be added and less of the gum. A very good varnish and not brittle may be made by dissolving gum anime in nut oil, boiling it

gently as the gum is added, and giving the oil as much gum as it will take up—the ground of which varnish may of itself be made of thin varnish by giving 2 or 3 coats of it; but when used it should be diluted with pure turpentine. Although this varnish is not brittle, it is liable to be indented with strokes, and it will not bear to be polished, but if well laid on, it will not need to be laid on afterwards; it also takes some time to dry. Heat applied to all oils, however, darken their colour; and oil varnishes for white grow very yellow if not exposed to a full clear light."

Red Japan Ground.

The base of this ground must be made up with madder lake ground with oil of turpentine; this forms the first ground. When perfectly dry, a second coat must be applied, composed of lake and white copal varnish; and the last with a coat composed of a mixture of copal and turpentine varnish mixed with lake. Vermilion or carmine can also be used for red japan instead of lake.

Orange Japan Ground

may be made of yellow mixed with vermilion or carmine, just as a bright or rather inferior colour is wanted. The yellow should always be in quantity to make a good full colour, and the red added in proportion to the depth of the tone required. If there is not a full good body of yellow, the colour will look watery or bare, as it is technically termed.

Yellow Japan Ground.

No. 1.—King's yellow may be used, and its effect will be heightened by dissolving powdered turmeric root in the spirits of wine, of which the upper or polishing coat is made, which spirits of wine must be strained off the dregs before the seedlac is added to it to form the varnish.

No. 2.—If turmeric be dissolved in the spirits of wine and strained through a cloth, and then mixed with pure seedlac varnish, it makes a good yellow japan. Saffron will answer

for the same purpose in the same way, but the brightest yellow ground is made by a primary coat of pure chrome yellow, and coated successively with the varnish.

No. 3.—Dutch pink is used for a kind of cheap yellow japan ground. If a little dragon's blood be added to the varnish for yellow japan, a most beautiful and rich salmon-coloured varnish is the result; and by these two mixtures all the shades of flesh-coloured japans are produced.

Green Japan Grounds.

A good blue may be made by mixing the Prussian blue along with the chromate of lead, or with turmeric or orpiment (sulphuret of arsenic) or ochre, only the two should be ground together and dissolved in alcohol and applied as a ground, then coated with four or five coats of shellac varnish in the manner already described. A very bright green is made by laying on a ground of Dutch metal or leaf of gold, and then coating it over with distilled verdigris dissolved in alcohol, then the varnish on top thus forms a splendid green, brilliant and glowing.

Blue Japan Grounds.

These may be formed of bright Prussian blue. The colour may be mixed with shellac varnish and brought to a polishing state by five or six coats of seedlac varnish. The varnish, however, is apt to give a greenish tint to all blue, as the varnish has a yellowish tinge, and blue and yellow form a green. Whenever a light blue is desired, the purest varnish must always be used.

Purple Japan Ground.

This is made by a mixture of lake and Prussian blue or carmine, or of an inferior colour varnish, and treated as the foregoing. When the ground is laid on and perfectly dried, a fine coat of pure boiled nut oil is then laid on and perfectly dried—a good method to ensure the japan against cracking. But a better plan is to use this oil in the varnish

given for the first coat after the ground is laid on, and which should contain a considerable quantity of turpentine. In every case where oil is used for any purpose for varnish, it is all the better if turpentine is mixed with it. Turpentine enables oil to mix with either alcohol or water. Alkalies have this property also.

Aniline Colours for Japanning.

Many of the clear varnishes and oils may be coloured directly with some of the aniline dyes by mixing the colouring material with the solvent used. These dyes do not hold their colour very well at high temperatures.

Black Inflexible Japan for Leather.

Ingredients.—1 oz. shellac, 4 ozs. wood naphtha; lamp-black to colour. Dissolve.

Carriage Japan.

Ingredients.—4 gallons raw linseed oil, 4 lbs. litharge, 2 lbs. red lead, 1 lb. black oxide of manganese, $3\frac{1}{4}$ ozs. white gum lac.

Preparation.—Set the oil over the fire and bring to the boiling point, add by degrees litharge and red lead alternatively and slowly; add the gum, and when this is melted, put in the manganese and keep the whole in rapid motion from the time the oil is 200° F. until the making is finished. When the mixture is cool enough to bear the finger in a moment, add from 2 to 3 gallons of spirit of turpentine.

Transparent Japan.

Ingredients and Preparation.—8 ozs. oil of turpentine, 6 ozs. oil of lavender, 1 drachm camphor, 2 ozs. bruised copal. Dissolve. This is used for japanning tin. Quick-drying copal varnish is usually substituted.

The Tortoiseshell Japan.

This kind of japan is very pretty and comparatively easy to manufacture. The work is first coated with a japan made by boiling 2 pints linseed oil to which 4 ozs. of water has been added, till it becomes thickened; the mixture is then strained and further boiled till it becomes of a pitchy consistency. This is mixed with turpentine to a workable consistency, and then applied. On a thoroughly dry coating of this japan lay a quantity of vermilion spots to represent the clear portion of the shell. The vermilion japan is made by adding vermilion to shellac varnish; it should be laid on thinly and dried. The whole surface is then finally coated with a thin layer of the above-described brown japan, still further diluted with turpentine. A long course of stoving will be necessary to thoroughly harden the japan.

Black Japan for Tin Lanterns.

Ingredients and Preparation.—1½ oz. asphaltum, 4 pints boiled linseed oil, 4 ozs. burnt umber. Heat till well mixed, and when cool, add turpentine till of a proper consistency.

To Japan Old Teatrays.

First clean them thoroughly with soap and water and a little rotten-stone, then dry by wiping and exposure at the fire. Now get some good copal varnish, mix with it some bronze powder, and apply with a brush to the denuded parts. After which, set the teatray in an oven at a heat of 212° F. to 300° F. until the varnish is dry. Two coats will make it equal to new.

Japan Flow for Tin.

No. 1. *Ingredients.*—3 quarts spirit of turpentine, 3 ozs. balsam of tolu, ¾ pint linseed oil, 3 ozs. acetate of lead, 3 ozs. balsam of fir, 1½ lb. sandarac.

Preparation.—Put all these materials, except the turpentine, in a suitable vessel, place over a slow fire at first, then

increase the heat until they are melted. When a little cool, stir in the turpentine and strain. This japan is transparent, but may be coloured if desired.

No. 2. *Ingredients and Preparation.*—Melt 5 lbs. Naples asphaltum, 12 ozs. dark gum anime. Boil for about two hours in $1\frac{1}{5}$ gallon linseed oil, then melt $1\frac{1}{5}$ lb. dark amber resin, and boil it with $\frac{1}{5}$ gallon linseed oil; add this to the other, and add driers. Boil for about two hours, or until the mass, when cooled, may be rolled into little pellets. Withdraw the heat and thin down with 3 gallons turpentine. The mass must be kept continually stirred to prevent it boiling over.

Imitation of Japanning.

The peculiar glossy surface on the so-called japan trays can only be given by practice; but a near imitation may be effected as follows:—Mix ivory black with melted size, apply the mixture quite hot to the box or any other wooden article that it may be desired to treat in this manner; when dry, sand-paper the box, then give another coat of black; when this second coat is dry, bring to smoothness with sand-paper, at the same time taking care not to remove the stain, so that the light wood below is exposed. Now procure 1 lb. of black japan and 1 gill of turpentine; mix enough of the black japan for present use with turpentine, of which only sufficient should be used to make the japan fluid enough to run from the brush. A fine-haired paint brush should be employed. If properly done, one coat will be sufficient. The box will look nearly equal to the japan goods. Dry the varnished box in a warm room free from dust.

Ordinary Process of Japanning.

From one to six or more coats of varnish are applied to the work in japanning, each coat being hardened in the oven before the next is put on. The last coat in coloured work is usually of clear varnish, without colouring matters, and is in fine work sometimes finished with rotten-stone and chamois. For ordinary work the gloss developed in the oven under favourable conditions is sufficient.

Japan Finishing.

The finishing part of japanning lies in laying on and polishing the outer coats of varnish, which is necessary in all painted or simply ground-coloured japan work. When brightness and clearness are wanted, the white kind of varnish is necessary; for seedlac varnish, which is the hardest and most tenacious, imparts a yellow tinge. A mixed varnish, we believe, is the best for this purpose, that is, for combining hardness and purity. Take then 3 ozs. of seedlac picked very carefully from all sticks and dirt, washing it well with cold water, stirring it up, pouring it off, and continuing the process until the water runs off perfectly clear; dry it, and then reduce it to powder, and put it with a pint of alcohol into a bottle, of which it must occupy only two-thirds of its space. This mixture must be shaken well together, and the bottle kept at a gentle heat (being corked) until the lac be dissolved. When this is the case the clear must be poured off, and the remainder strained and poured into a well-stoppered bottle. The manner of using this seedlac varnish is the same as that before described, and a fine polishing surface is made by mixing this with pure white varnish. The pieces of work to be varnished for finishing should be placed near a stove or in a warm dry room, and one coat should be perfectly dry before the other is applied. The varnish is applied by proper brushes, beginning at the middle, passing the stroke to one end, and work the other stroke from the middle to the other end. Great skill is displayed in laying on these coats of varnish. If possible the brush should never cross or twice pass over in giving one coat. When one coat is dry another must be laid over it, and so on successively for a number of coats, so that the coating should be sufficiently thick to stand fully all the polishing, so as not to bare the surface of the coloured work. When a sufficient number of coats are thus laid on, the work is fit to be polished, which, in common cases, is commenced with a rag dipped in finely powdered rotten-stone, and towards the end of the rubbing a little oil should be used alone to clean off the powder and give the work a still brighter hue. In very fine work

French whiting should be used, which should be washed in water to remove any sand that might be in it. Pumice-stone ground to a very fine powder is used for the first part of the polishing, and the finishing done with whiting. It is always best to dry the varnish of all japan work by heat. The metal will stand the greatest heat, and care must be taken not to darken by too high a temperature when gold size is used in gilding for japan work. When it is desired with the gold shine, or to appear burnished, the gold size should be used with a little of the spirit of turpentine and a little oil; but when a considerable degree of lustre is wanted without burnishing and the preparation necessary for it, a little of the size along with oil alone should be used.

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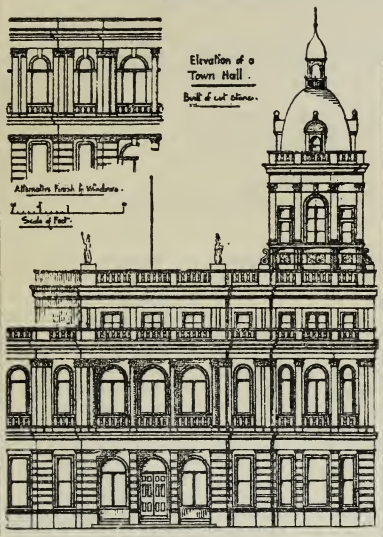

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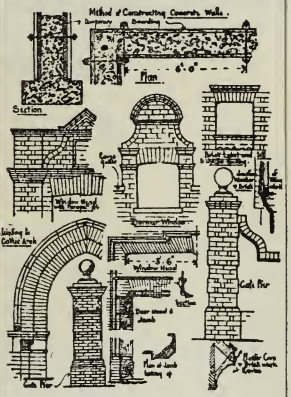

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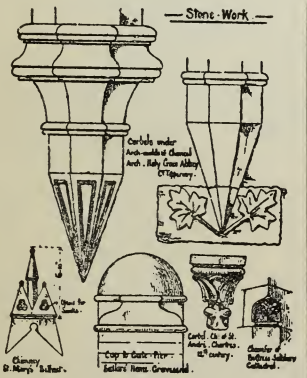
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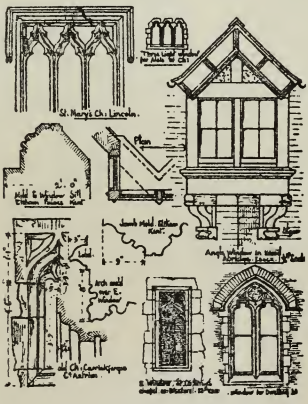

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